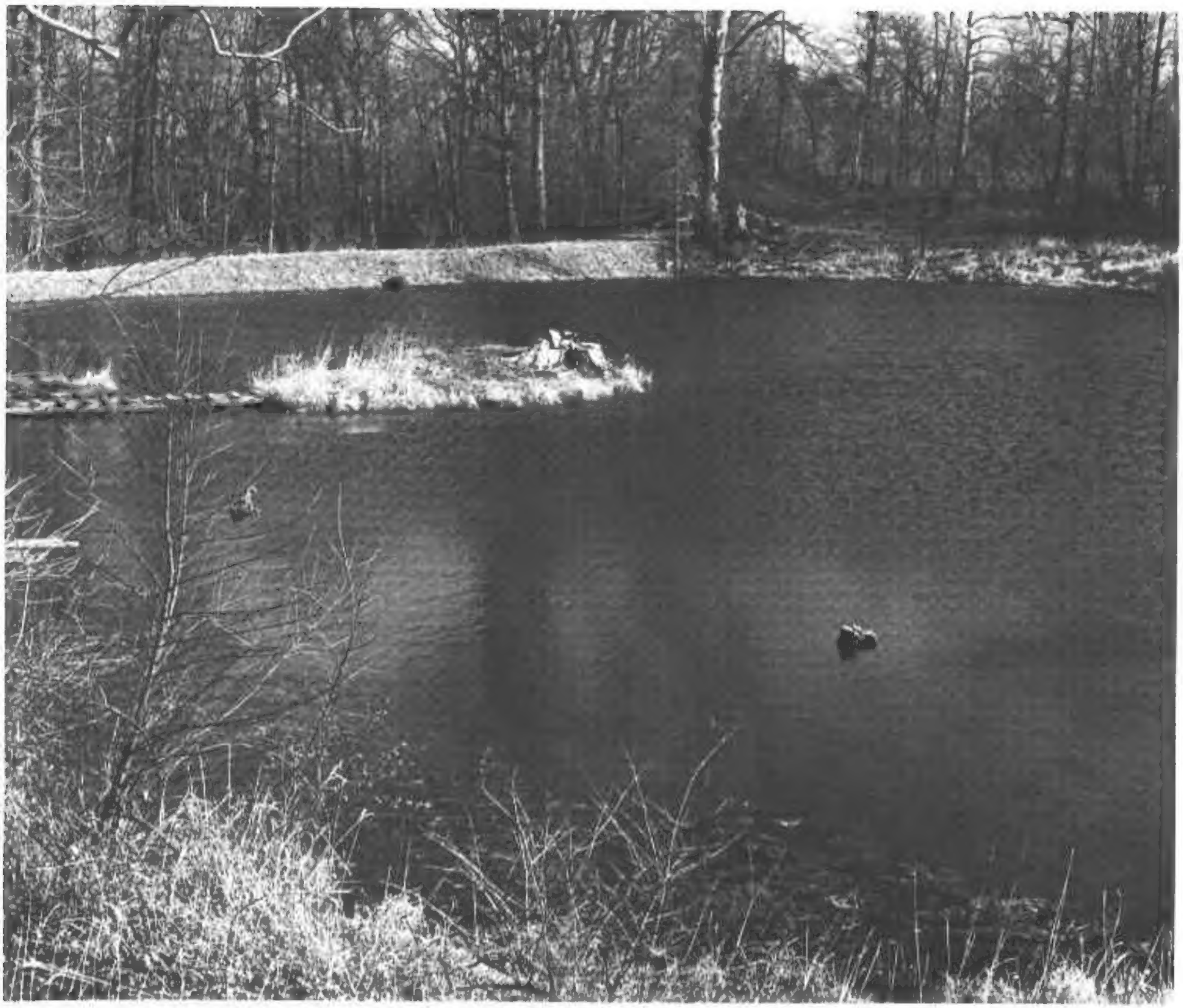
United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Purdue University,
Agricultural Experiment
Station; and Indiana
Department of Natural
Resources, State Soil
Conservation Board and
Division of Soil
Conservation

Soil Survey of Carroll County, Indiana



How To Use This Soil Survey

General Soil Map

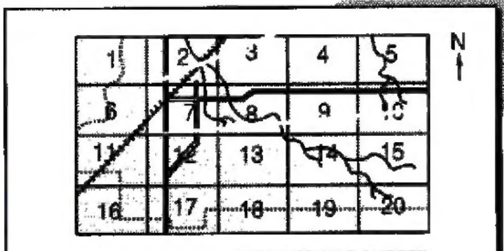
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

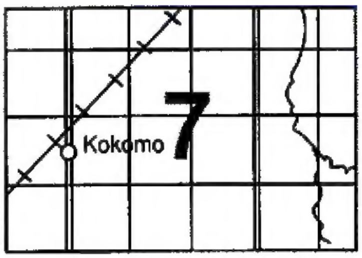
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

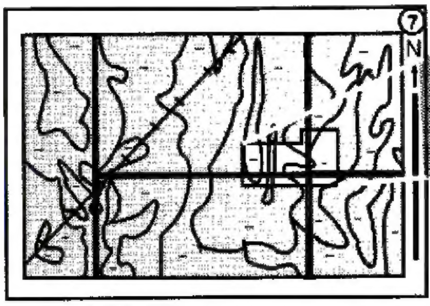


INDEX TO MAP SHEETS

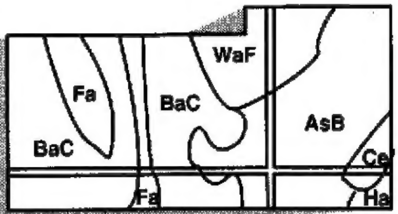


MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed during 1983 to 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This soil survey was made cooperatively by the Soil Conservation Service; Purdue University, Agricultural Experiment Station; and the Indiana Department of Natural Resources, State Soil Conservation Board and Division of Soil Conservation. It is part of the technical assistance furnished to the Carroll County Soil and Water Conservation District. Financial assistance was made available by the Carroll County Board of County Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Pond in an area of Ockley loam, till substratum, 2 to 6 percent slopes, eroded.

Contents

Issued January 1991

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Carroll County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L. Eddleman

Robert L. Eddleman
State Conservationist
Soil Conservation Service

Location of Carroll County in Indiana.

Soil Survey of Carroll County, Indiana

By Earnest L. Jensen, Soil Conservation Service

Fieldwork by Earnest L. Jensen, Soil Conservation Service, and Randy J. Braun and Edwin A. Taylor, State Soil Conservation Board, Indiana Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service, in cooperation with Purdue University, Agricultural Experiment Station; and Indiana Department of Natural Resources, State Soil Conservation Board and Division of Soil Conservation

Carroll County is in the north-central part of Indiana. It covers an area of about 375 square miles, or 239,993 acres. At its widest points, the county extends about 21 miles from north to south and about 21 miles from west to east. The population is about 19,700. Delphi, the largest city, is the county seat.

The first soil survey of Carroll County, Indiana, was published in 1958 *(4)*. This survey updates the first survey and provides additional information and larger maps that show the soils in greater detail.

About 82 percent of the county is cropland or pasture. Corn, soybeans, and small grains are the principal crops. A few small but productive truck farms and orchards are in the county. Some farms have cattle, hog, or poultry enterprises. Most of the hog and poultry operations are managed in confined quarters and in conjunction with grain farming. Very few dairy farms are in the county.

Agricultural business and industry provide job opportunities for many local residents. A variety of small, privately owned recreational facilities attract people from surrounding areas.

General Nature of the County

This section gives general information about the county. It discusses settlement of the county, geology, relief and drainage, natural resources, transportation facilities, and climate.

Settlement of the County

French explorers and traders first visited the area of what is now Carroll County in about 1700. At that time all the area north of the Wabash River was Indian territory. The sale of government land at Crawfordsville (Montgomery County) on December 21, 1824, opened the area to the first permanent English settlers. The first tract of land, along Deer Creek south of the present site of Delphi, was bought by Henry Robinson on December 30, 1824.

Fear of the Indians and rumors of unhealthy living conditions slowed settlement. The Indians moved westward after the treaty of 1826, and the county was organized by an act of the General Assembly on January 7, 1828.

The earliest settlements were along Deer Creek, Bachelor Run, and Rock Creek *(6)*. Most of the settlers came from southern Indiana, Pennsylvania, Ohio, Virginia, Kentucky, and later from North Carolina and New York. They generally traveled down the Ohio River to Cincinnati and then overland to Lafayette as the Robinson group had done, or they followed the Ohio and Wabash Rivers to the area.

The population of the county was 16,152 by 1879 and 20,021 by 1900 *(10)*, then decreased to 15,049 in 1930. Since that time, the population has gradually increased. Carroll County is predominantly rural.

Geology

Glaciation has played a major role in the formation of topography in Carroll County. Ice flowed across Indiana from the northeast and acted as an erosional agent to alter the existing landscape. Erosional debris in the flowing ice sheet was deposited along the outer edges of the glacier. As the ice retreated, it left a relatively flat plain (ground moraine) in its wake. At times the front remained stationary, and sediment accumulated to produce an irregular ridge called an end moraine *(2, 7)*. The glacier formed a new landscape, a series of long, concentric ridges separated by flat plains, both of which are underlain by nonsorted, nonstratified sediment called till.

The glacial materials have been deposited on sedimentary rocks of the Silurian and Ordovician ages. Bedrock of the Silurian age is exposed at the surface along the Wabash River and Deer Creek near Delphi.

The Teays River Valley that developed before glaciation is still present in Carroll County, but it is now completely filled by glacial drift. The Teays River originated in the Piedmont of North Carolina and flowed northwest across West Virginia and Ohio and then west across Indiana. It entered Carroll County from the north near Burnetts Creek and flowed southeast across the county. From there, the river continued southwest in a winding pattern across Indiana and Illinois to the Mississippi River Valley.

Relief and Drainage

The highest point in Carroll County, near the southeast corner of the county, is about 840 feet above sea level. The lowest point, 520 feet above sea level, is in the western part where the Wabash River leaves the county.

The county is generally a flat plain dissected and drained by the Wabash and Tippecanoe Rivers and numerous creeks, streams, and ditches. The greatest extent of relief is along the Wabash River Valley.

The Wabash River enters the northern part of the county from the east and flows southwest past Delphi before it leaves the county. Its tributaries are Tannery Branch, Pleasant Run, Rock Creek, Little Rock Creek, Mitchell Creek, Burnetts Creek, Rattlesnake Creek, Deer Creek, Wildcat Creek, and the Middle Fork of Wildcat Creek. The Tippecanoe River enters the northwestern part of the county and flows south into Tippecanoe County. Its tributaries are Big Creek and Spring Creek.

Natural Resources

Soil is the most important natural resource in Carroll County. Corn, soybeans, wheat, beef, pork, and dairy products are the main marketable products. Limestone, sand, and gravel quarries are along the Wabash River and its tributaries.

Water for cities, towns, and rural areas is obtained from municipal and private wells. The water used in the county is mostly ground water pumped out of glacial drift. The average depth of the water is 150 to 250 feet.

Transportation Facilities

Carroll County has one federal highway, five state highways, and about 880 miles of county roads. Most county roads are on section lines, and many have a bituminous surface. Two municipal airports serve small private planes. A number of communities have rail service. Commercial bus transportation is also available.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Carroll County is cold in winter and quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes droughtiness during summer on most soils. Normal annual precipitation is adequate for all crops that are adapted to the temperature and the length of the growing season in the area.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Delphi, Indiana, in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 29 degrees F and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Delphi on January 28, 1963, is -25 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive

plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 37 inches. Of this, more than 23 inches, or about 62 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 6.96 inches at Delphi on May 16, 1968. Thunderstorms occur on about 44 days each year.

The average seasonal snowfall is nearly 23 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 21 days of the year have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are generally local and of short duration and cause damage in a variable pattern.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot

experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general soil map units in this soil survey do not always agree or fully join with those of adjoining counties published at an earlier date. Differences are a result of better knowledge of soils and of modification or refinement in soils series concepts, intensity of mapping, and extent of the soils within the survey area. Other differences are brought about by a different predominance of soil in map units made up of two or three soil series. Still other differences may be caused by the range in slope allowed within the map unit of adjoining surveys. In this county or in adjacent counties, a map unit is sometimes too small to be delineated.

Soil Descriptions

Nearly Level and Gently Sloping Soils That Are Very Poorly Drained to Well Drained; on Till Plains and Outwash Plains

These soils make up about 68 percent of the county. They generally have a seasonal high water table. Most areas are drained and are used for corn, soybeans, or small grain. Some are used for hay, pasture, or woodland. These soils are well suited to row crops. They generally are severely limited as sites for sanitary facilities and buildings.

1. Cyclone-Fincastle-Starks

Deep, nearly level and gently sloping, poorly drained and somewhat poorly drained, moderately fine textured and medium textured soils that formed in silty material over calcareous glacial till or glacial outwash; on till plains and outwash plains

This map unit consists of soils in depressions and on rises on till plains and outwash plains. Slopes range from 0 to 3 percent.

This map unit makes up about 31 percent of the county. It is about 36 percent Cyclone soils, 33 percent Fincastle soils, 16 percent Starks soils, and 15 percent minor soils (fig. 1).

The poorly drained, nearly level Cyclone soils are in broad depressional areas and in fingerlike areas extending between areas of better drained soils on slight rises. Typically, they have a surface soil of very dark gray silty clay loam and a subsoil of dark gray, dark grayish brown, grayish brown, and brown, mottled silty clay loam and loam.

The somewhat poorly drained, nearly level and gently sloping Fincastle soils are on slight rises. Typically, they have a surface layer of dark brown silt loam and a subsoil of grayish brown, dark yellowish brown, and brown, mottled silty clay loam, clay loam, and loam.

The somewhat poorly drained, nearly level and gently sloping Starks soils are on slight rises. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of brown, mottled silty clay loam, loam, and fine sandy loam.

The minor soils are the very poorly drained Milford and Houghton and poorly drained Pella soils in depressions, the well drained Martinsville and Miami soils on ridges and knolls, and the moderately well drained Rockfield and Williamstown soils on ridges and knolls. The Martinsville soils have a till substratum.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to

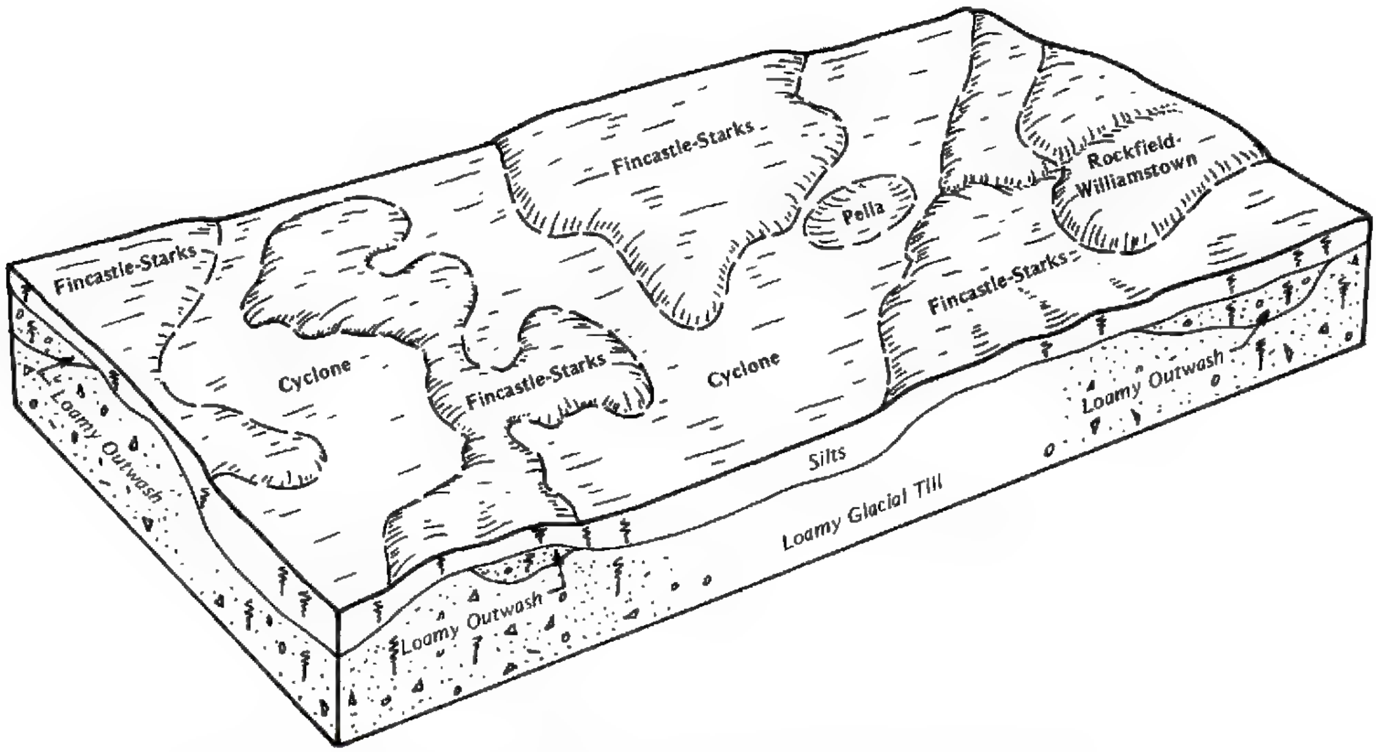


Figure 1.—Pattern of soils and parent material in the Cyclone-Fincastle-Starks map unit.

these uses. Excess water and erosion are the main management concerns. The Cyclone soils are susceptible to ponding during periods of heavy precipitation. The nearly level and gently sloping Fincastle and Starks soils are more susceptible to erosion if vegetation is removed.

These soils are well suited to trees. They are best suited to water-tolerant species. Ponding and a seasonal high water table are limitations.

The Fincastle and Starks soils are poorly suited to building site development and sanitary facilities, and the Cyclone soils are generally unsuited. Ponding, wetness, and moderately slow permeability are the major limitations.

2. Cyclone-Kendall-Fincastle

Deep, nearly level, poorly drained and somewhat poorly drained, moderately fine textured and medium textured soils that formed in silty material over glacial till or glacial outwash; on till plains and outwash plains

This map unit consists of soils in depressional areas and on slight rises on till plains and outwash plains. Slopes are 0 to 1 percent.

This map unit makes up about 9 percent of the county. It is about 47 percent Cyclone soils, 36 percent Kendall soils, 9 percent Fincastle soils, and 8 percent minor soils.

The poorly drained Cyclone soils are in depressional areas and in fingerlike areas extending between areas of better drained soils on slight rises. Typically, they have a surface soil of very dark gray silty clay loam and a subsoil of dark gray, dark grayish brown, grayish brown, and brown, mottled silty clay loam and loam.

The somewhat poorly drained Kendall soils are on slight rises. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of brown, dark yellowish brown, and yellowish brown, mottled silty clay loam and silt loam.

The somewhat poorly drained Fincastle soils are on slight rises. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of brown, grayish brown, and dark grayish brown, mottled silty clay loam and clay loam.

The minor soils are the very poorly drained Milford and poorly drained Pella soils in depressions and the moderately well drained Rockfield and Williamstown soils on ridges and knolls.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Excess water is the main management concern. The Cyclone soils are susceptible to ponding during periods of heavy precipitation.

These soils are well suited to trees. They are best suited to water-tolerant species. Ponding and a seasonal high water table are limitations.

The Kendall and Fincastle soils are poorly suited to building site development and sanitary facilities, and the Cyclone soils are generally unsuited. Wetness, ponding, and moderately slow permeability are the major limitations.

3. Starks-Patton

Deep, nearly level, somewhat poorly drained and poorly drained, medium textured and moderately fine textured soils that formed in silty material or in silty material over glacial outwash; on outwash plains

This map unit consists of soils on slight rises and in broad depressional areas on outwash plains. Slopes range from 0 to 2 percent.

This map unit makes up about 5 percent of the county. It is about 56 percent Starks soils, 29 percent Patton soils, and 15 percent minor soils.

The somewhat poorly drained Starks soils are on slight rises on outwash plains. Typically, they have a surface layer of dark brown silt loam and a subsoil of grayish brown, dark yellowish brown, and brown, mottled silty clay loam, silt loam, and clay loam.

The poorly drained Patton soils are in depressional areas on outwash plains. Typically, they have a surface soil of very dark gray silty clay loam and a subsoil of dark gray, dark grayish brown, grayish brown, and gray, mottled silty clay loam.

The minor soils are the well drained Camden soils on slight rises, ridges, and knolls, the moderately well drained Rockfield and Williamstown soils on ridges and knolls, and the poorly drained Pella soils in depressions.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Excess water is the main management concern. The Patton soils are susceptible to ponding during periods of heavy precipitation.

These soils are well suited to trees. They are best suited to water-tolerant species. Ponding and a seasonal high water table are limitations.

The Starks soils are poorly suited to building site development and sanitary facilities, and the Patton soils are generally unsuited. Ponding, wetness, and moderately slow permeability are the major limitations.

4. Mahalasville, till substratum-Waynetown, till substratum-Sleeth

Deep, nearly level, very poorly drained and somewhat poorly drained, medium textured and moderately fine textured soils that formed in silty material and loamy glacial outwash over glacial till; on outwash plains

This map unit consists of soils in depressions and on rises on outwash plains. Slopes range from 0 to 2 percent.

This map unit makes up about 7 percent of the county. It is about 40 percent Mahalasville soils, 29 percent Waynetown soils, 23 percent Sleeth soils, and 8 percent minor soils (fig. 2). The Mahalasville and Waynetown soils have a till substratum.

The very poorly drained Mahalasville soils are in depressional areas. Typically, they have a surface soil of black silty clay loam and a subsoil of dark grayish brown and grayish brown, mottled silty clay loam and clay loam.

The somewhat poorly drained Waynetown soils are on slight rises. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of brown, dark yellowish brown, and dark grayish brown, mottled silty clay loam, very fine sandy loam, fine sandy loam, gravelly clay loam, and gravelly loam.

The somewhat poorly drained Sleeth soils are on slight rises. Typically, they have a surface layer of dark brown silt loam and a subsoil of brown, dark yellowish brown, and dark grayish brown, mottled silty clay loam, clay loam, and gravelly sandy clay loam.

The minor soils are the well drained Alvin, Ockley, and Rush soils on slight rises, ridges, and knolls and the very poorly drained Milford and poorly drained Pella soils in depressions. The Ockley and Rush soils have a till substratum.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Wetness is the main management concern. The Mahalasville soils are susceptible to ponding during periods of heavy precipitation.

These soils are well suited to trees. They are best suited to water-tolerant species. Ponding and a seasonal high water table are limitations.

The Waynetown and Sleeth soils are poorly suited to building site development and sanitary facilities, and the

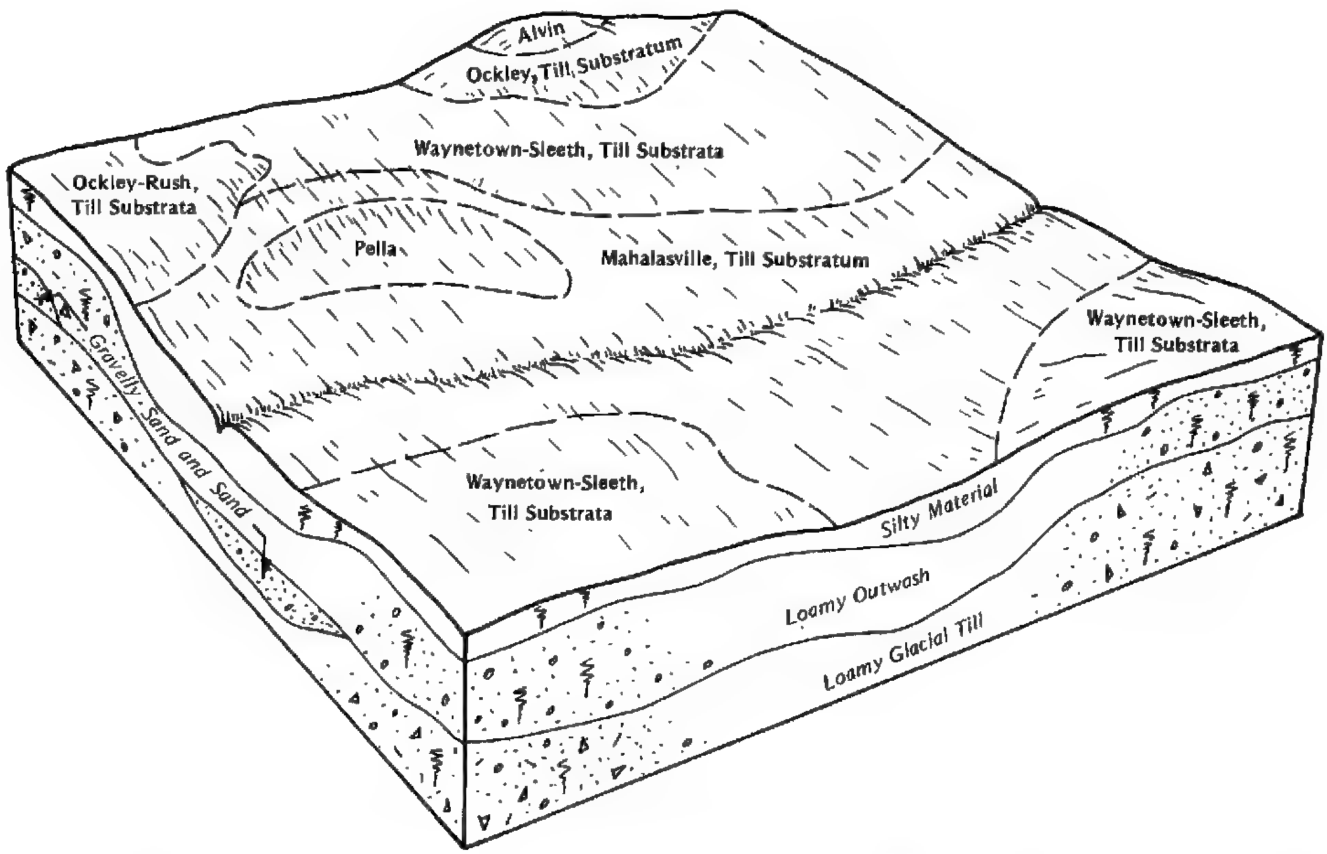


Figure 2.—Pattern of soils and parent material in the Mahalasville, till substratum-Waynetown, till substratum-Sleeth map unit.

Mahalasville soils are generally unsuited. Wetness, ponding, and moderately slow permeability are major limitations.

5. Camden-Kendall-Patton

Deep, nearly level and gently sloping, well drained, somewhat poorly drained, and poorly drained, medium textured and moderately fine textured soils that formed in silty material and glacial outwash; on outwash plains

This map unit consists of soils on slight rises, in depressional areas, and on ridges and knolls. Slopes range from 0 to 6 percent.

This map unit makes up about 3 percent of the county. It is about 79 percent Camden soils, 12 percent Kendall soils, 5 percent Patton soils, and 4 percent minor soils.

The well drained, nearly level and gently sloping Camden soils are on slight rises, ridges, and knolls. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown silty clay loam and clay loam.

The somewhat poorly drained, nearly level Kendall soils are on slight rises. Typically, they have a surface layer of dark brown silt loam and a subsoil of grayish brown, brown, and yellowish brown, mottled silty clay loam and silt loam.

The poorly drained, nearly level Patton soils are in depressional areas. Typically, they have a surface soil of very dark gray silty clay loam and a subsoil of dark gray, dark grayish brown, grayish brown, and gray, mottled silty clay loam.

The minor soils are the poorly drained Pella soils in depressions.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Excess water and erosion are the main management concerns. The Patton soils are susceptible to ponding during periods of heavy precipitation. The Camden soils are more susceptible to erosion if vegetation is removed.

These soils are well suited to trees. They are best suited to water-tolerant species. Ponding and a seasonal high water table are limitations.

The Camden soils are well suited to building site development and sanitary facilities. The Kendall soils are poorly suited, and the Patton soils are generally unsuited. Wetness, ponding, moderately slow permeability, and shrinking and swelling are the major limitations.

6. Rockfield-Fincastle-Starks

Deep, nearly level and gently sloping, moderately well drained and somewhat poorly drained, medium textured soils that formed in silty material over glacial outwash or glacial till; on till plains

This map unit consists of soils on ridges, knolls, and slight rises on till plains. Slopes range from 0 to 6 percent.

This map unit makes up about 13 percent of the county. It is about 48 percent Rockfield soils, 21 percent Fincastle soils, 12 percent Starks soils, and 19 percent minor soils.

The moderately well drained Rockfield soils are on ridges and knolls. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown, dark brown, and brown, mottled silty clay loam, clay loam, sandy clay loam, sandy loam, and loam.

The somewhat poorly drained Fincastle soils are on slight rises. Typically, they have a surface layer of dark brown silt loam and a subsoil of grayish brown, dark yellowish brown, and brown, mottled silty clay loam, clay loam, and loam.

The somewhat poorly drained Starks soils are on slight rises. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of brown, mottled silty clay loam, loam, and fine sandy loam.

The minor soils are the well drained Hennepin, Martinsville, and Miami and moderately well drained Williamstown soils on ridges and knolls and the poorly drained Cyclone soils in depressions. The Martinsville soils have a till substratum.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Erosion and excess water are the main management concerns. The soils are susceptible to erosion if vegetation is removed.

These soils are well suited to trees. Plant competition is a management concern.

The Rockfield soils are fairly well suited to building site development and sanitary facilities, and the Fincastle and Starks soils are poorly suited. Wetness, shrinking and swelling, and moderately slow permeability are the major limitations.

Nearly Level to Moderately Steep Soils That Are Well Drained and Somewhat Poorly Drained; on Till Plains

These soils make up about 4 percent of the county. They generally have a seasonal high water table or are highly erodible. Most areas are used for corn, soybeans, or small grain. Many of the steeper areas are used for hay, pasture, or woodland. The nearly level and gently sloping soils are well suited to row crops. They generally are severely limited as sites for sanitary facilities and buildings.

7. Riddles-Miami-Crosier

Deep, nearly level to moderately steep, well drained and somewhat poorly drained, medium textured and moderately fine textured soils that formed in glacial till; on till plains

This map unit consists of soils on ridges, knolls, and slight rises on till plains. Slopes range from 1 to 20 percent.

This map unit makes up about 3 percent of the county. It is about 26 percent Riddles soils, 24 percent Miami soils, 18 percent Crosier soils, and 32 percent minor soils.

The well drained, gently sloping to moderately steep Riddles soils are on ridges and knolls. Typically, they have a surface layer of brown loam and a subsoil of dark yellowish brown clay loam, sandy loam, and sandy clay loam.

The well drained, gently sloping to moderately steep Miami soils are on ridges and knolls. Typically, they have a surface layer of brown loam or clay loam and a subsoil of dark yellowish brown and brown clay loam and loam.

The somewhat poorly drained, nearly level to gently sloping Crosier soils are on slight rises. Typically, they have a surface layer of brown loam and a subsoil of dark yellowish brown, mottled clay loam.

The minor soils are the well drained Alvin soils on ridges, the somewhat poorly drained Whitaker soils on slight rises, and the very poorly drained Mahalasville, Milford, Treaty, and Wallkill soils in depressions. The Whitaker soils have å till substratum.

Most areas are used for cultivated crops. The more sloping areas are used for hay or pasture. The gently sloping soils are well suited to cultivated crops, hay, and pasture. The more sloping soils are not as well suited because of the hazard of erosion and the limitation of slope. Excess water is a management

concern in areas of the Crosier soils. These soils are susceptible to erosion if vegetation is removed.

These soils are well suited to trees. Plant competition is a management concern.

The Riddles and Miami soils are fairly well suited to building site development and sanitary facilities, and the Miami and Crosier soils are poorly suited. Wetness, slope, shrinking and swelling, and moderately slow permeability are the major limitations.

8. Martinsville, till substratum-Miami-Crosby

Deep, nearly level to moderately steep, well drained and somewhat poorly drained, medium textured soils that formed in loamy glacial outwash over glacial till, in glacial till, or in silty material over glacial till; on till plains

This map unit consists of soils on ridges, knolls, and slight rises on till plains. Slopes range from 1 to 20 percent.

This map unit makes up about 1 percent of the county. It is about 52 percent Martinsville soils, 28 percent Miami soils, 11 percent Crosby soils, and 9 percent minor soils. The Martinsville soils have a till substratum.

The well drained, gently sloping and moderately sloping Martinsville soils are on ridges and knolls. Typically, they have a surface layer of brown loam and a subsoil of dark yellowish brown and brown clay loam, sandy loam, and sandy clay loam.

The well drained, gently sloping to moderately steep Miami soils are on ridges and knolls. Typically, they have a surface layer of brown loam and a subsoil of dark yellowish brown clay loam.

The somewhat poorly drained, nearly level to gently sloping Crosby soils are on slight rises. Typically, they have a surface layer of brown silt loam and a subsoil of brown and dark yellowish brown, mottled silty clay loam, clay loam, and loam.

The minor soils are the well drained Hennepin soils on ridges, the poorly drained Cyclone, Patton, and Washtenaw and very poorly drained Milford, Houghton, and Wallkill soils in depressions, and the somewhat poorly drained Fincastle soils on slight rises.

Most areas are used for cultivated crops. The more sloping areas are used for hay or pasture. The gently sloping soils are well suited to cultivated crops, hay, and pasture. The more sloping soils are not as well suited because of the hazard of erosion and the slope. Excess water is a management concern in areas of the Crosier soils.

These soils are well suited to trees. Plant competition is a management concern.

The Martinsville and Miami soils are fairly well suited to building site development and sanitary facilities, and the Crosby soils are poorly suited. Wetness, slope, shrinking and swelling, and moderately slow permeability are the major limitations.

Nearly Level to Strongly Sloping Soils That Are Well Drained and Excessively Drained; on Terraces

These soils make up about 1 percent of the county. They are underlain by sand and gravel. Most areas are used for corn, soybeans, or small grain. Many of the steeper areas are used for hay, pasture, or woodland. The moderately fine textured soils are well suited to row crops. The limitations affecting sanitary facilities and building site development range from slight to severe.

9. Ormas-Fox-Coloma

Deep, nearly level to strongly sloping, well drained and excessively drained, coarse textured, moderately coarse textured, and moderately fine textured soils that formed in sandy sediments or in loamy sediments that are moderately deep over sand and very gravelly coarse sand; on terraces

This map unit consists of soils in nearly level areas and on ridges of terraces. Slopes range from 0 to 15 percent.

This map unit makes up about 1 percent of the county. It is about 37 percent Ormas soils, 25 percent Fox soils, 20 percent Coloma soils, and 18 percent minor soils (fig. 3).

The well drained, nearly level and gently sloping Ormas soils are on ridges and knolls. Typically, they have a surface layer of dark yellowish brown loamy sand, a subsurface layer of brown and yellowish brown sand, and a subsoil of dark yellowish brown and dark brown sandy loam and gravelly sandy clay loam.

The well drained, nearly level to strongly sloping Fox soils are on ridges and knolls. Typically, they have a surface layer of dark brown sandy loam or brown gravelly clay loam and a subsoil of brown and dark brown gravelly sandy loam and gravelly clay loam.

The excessively drained, nearly level to moderately sloping Coloma soils are on ridges and knolls. Typically, they have a surface layer of dark brown loamy sand, a subsurface layer of yellowish brown and light yellowish brown loamy sand, and a subsoil of light yellowish brown and yellowish brown loamy sand and sandy loam.

The minor soils are the well drained Piankeshaw Variant soils on alluvial fans, the well drained Landes and Landes Variant and somewhat excessively drained

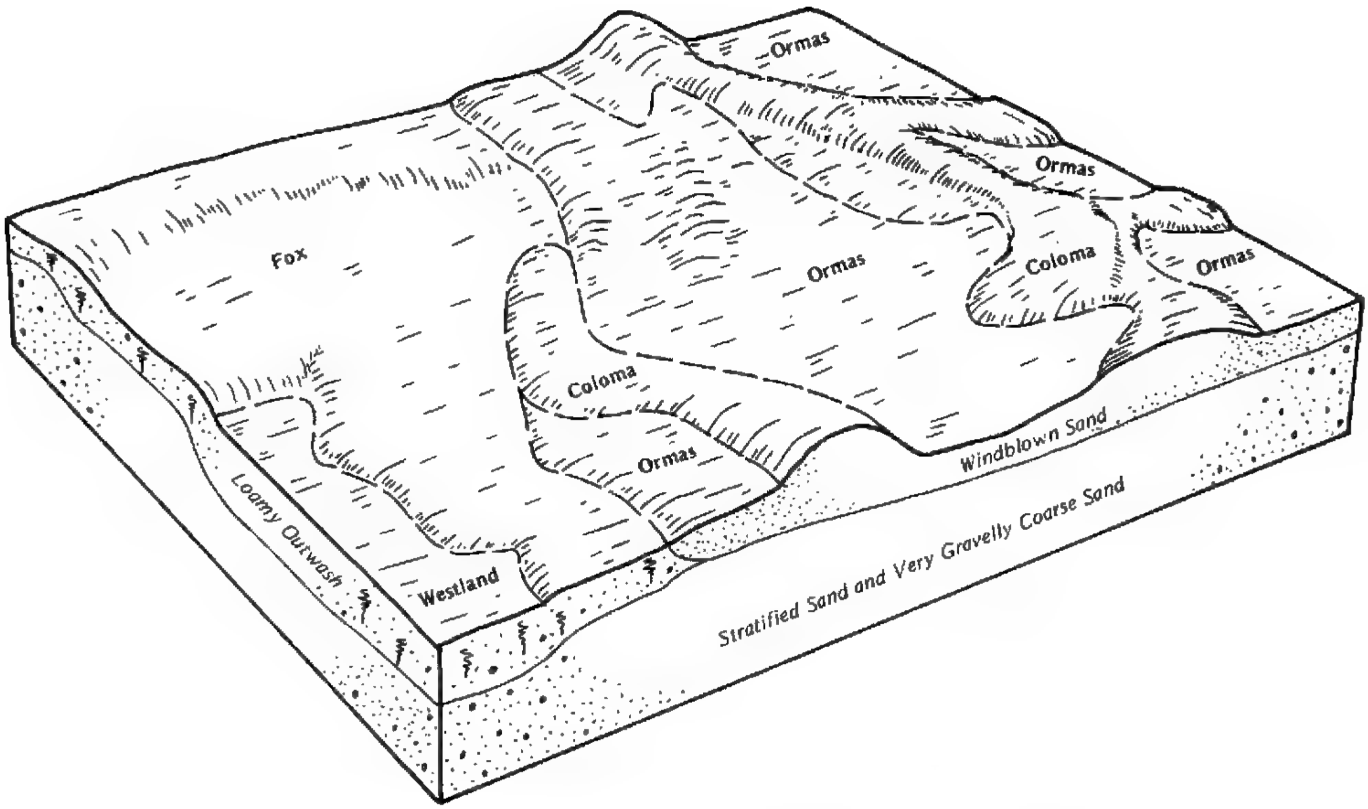


Figure 3.—Pattern of soils and parent material in the Ormas-Fox-Coloma map unit.

Moundhaven soils in nearly level areas on flood plains, the very poorly drained Westland soils in depressions on terraces, and the somewhat poorly drained Ceresco soils on slight rises on flood plains.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are fairly well suited to these uses. Erosion, soil blowing, and droughtiness are the main management concerns. The gently sloping and moderately sloping Fox soils are more susceptible to erosion if vegetation is removed.

These soils are well suited to trees. Seedling mortality and plant competition are management concerns.

These soils are well suited to building site development. The slope is a concern in the moderately sloping areas of the Fox and Ormas soils. These soils are poorly suited to sanitary facilities because of poor filtering qualities.

Nearly Level to Strongly Sloping Soils That Are Well Drained; on Outwash Plains and Terraces

These soils make up about 13 percent of the county. They generally are underlain by sand and gravel or by glacial till. Most areas are used for corn, soybeans, or small grain. Some are used for hay, pasture, or woodland. The medium textured soils are well suited to row crops. The limitations affecting sanitary facilities and building site development range from slight to severe.

10. Ockley, till substratum-Kalamazoo-Rush, till substratum

Deep, nearly level and gently sloping, well drained, medium textured soils that formed in silty material and loamy glacial outwash over sand and very gravelly coarse sand; on outwash plains

This map unit consists of soils in nearly level areas and on ridges of outwash plains. Slopes range from 0 to 6 percent.

This map unit makes up about 7 percent of the county. It is about 44 percent Ockley soils, 30 percent Kalamazoo soils, 19 percent Rush soils, and 7 percent

minor soils. The Ockley and Rush soils have a till substratum.

The nearly level and gently sloping Ockley soils are on ridges and knolls. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown, brown, and dark brown silty clay loam, clay loam, and gravelly clay loam.

The nearly level and gently sloping Kalamazoo soils are on ridges and knolls. Typically, they have a surface layer of dark brown loam and a subsoil of brown and dark brown clay loam, sandy clay loam, sandy loam, loamy coarse sand, and gravelly loamy coarse sand.

The Rush soils are in nearly level areas. Typically, they have a surface soil of dark brown silt loam and a subsoil of dark yellowish brown, brown, and dark brown silty clay loam, clay loam, gravelly sandy loam, and gravelly sandy clay loam.

The minor soils are the well drained Alvin, Casco, and Kendallville soils on ridges and knolls, the very poorly drained Mahalasville soils in depressions, and the somewhat poorly drained Sleeth and Waynetown soils on slight rises. The Mahalasville and Waynetown soils have a till substratum.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Erosion and droughtiness are the main management concerns.

These soils are well suited to trees. Plant competition is a management concern.

These soils are fairly well suited to building site development. The Ockley soils are fairly well suited to sanitary facilities, and the Rush and Kalamazoo soils are poorly suited. Shrinking and swelling, moderate and moderately slow permeability, and poor filtering qualities are the main limitations.

11. Ockley-Fox-Mudlavia

Deep, nearly level to strongly sloping, well drained, medium textured, moderately coarse textured, and moderately fine textured soils that formed in silty sediments and in loamy sediments that are moderately deep over sand and very gravelly coarse sand; on terraces

This map unit consists of soils on terraces. Slopes range from 0 to 15 percent.

This map unit makes up about 6 percent of the county. It is about 50 percent Ockley soils, 8 percent Fox soils, 8 percent Mudlavia soils, and 34 percent minor soils.

The nearly level and gently sloping Ockley soils are on ridges and knolls. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown, dark brown, and brown silty clay loam, clay loam, gravelly sandy clay loam, and gravelly clay loam.

The nearly level to strongly sloping Fox soils are on ridges and knolls. Typically, they have a surface layer of brown gravelly clay loam and a subsoil of brown and reddish brown gravelly clay loam and gravelly sandy clay loam.

The Mudlavia soils are in nearly level and gently sloping areas. Typically, they have a surface layer of dark brown gravelly sandy loam and a subsoil of brown and dark reddish brown very gravelly clay loam, extremely gravelly clay loam, and extremely gravelly clay.

The minor soils are the well drained Piankeshaw Variant soils on gently sloping alluvial fans, the well drained Casco and Ormas and excessively drained Coloma soils on ridges and knolls of terraces, and the very poorly drained Westland and Palms soils in depressions on terraces. The Palms soils have a cobbly substratum.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Erosion and droughtiness are the main management concerns.

These soils are well suited to trees. Plant competition is a management concern.

These soils are fairly well suited to building site development. Slope is a concern in the moderately sloping areas of the Fox soils. The Ockley soils are well suited to sanitary facilities, the Mudlavia soils are fairly well suited, and the Fox soils are poorly suited. Large stones, shrinking and swelling, poor filtering qualities, and moderate permeability are the main limitations.

Nearly Level and Gently Sloping Soils That Are Moderately Well Drained to Somewhat Excessively Drained; on Flood Plains and Terraces

These soils make up about 8 percent of the county. Most of the soils are subject to flooding or are underlain by sand and gravel. Most areas are used for corn, soybeans, or small grain. Some are used for hay, pasture, or woodland. All but the coarse textured soils are well suited to row crops. The limitations affecting sanitary facilities and building site development range from slight to severe.

12. Moundhaven-Landes-Ockley

Deep, nearly level and gently sloping, somewhat excessively drained to moderately well drained, coarse

textured to medium textured soils that formed in sandy and loamy alluvium or in silty sediments and glacial outwash; on flood plains and terraces

This map unit consists of soils on flood plains and terraces. Slopes range from 0 to 6 percent.

This map unit makes up about 6 percent of the county. It is about 30 percent Moundhaven and similar soils, 28 percent Landes and similar soils, 10 percent Ockley soils, and 32 percent minor soils.

The somewhat excessively drained, nearly level Moundhaven soils are on flood plains. Typically, they have a surface soil of dark grayish brown loamy fine sand and a subsoil of brown loamy fine sand.

The well drained and moderately well drained, nearly level Landes soils are on flood plains. Typically, they have a surface soil of very dark grayish brown fine sandy loam or loam and a subsoil of dark brown, brown, and dark yellowish brown fine sandy loam and sandy loam.

The well drained, nearly level and gently sloping Ockley soils are on ridges and knolls of terraces. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown, brown, and dark brown silty clay loam, clay loam, gravelly sandy clay loam, and gravelly clay loam.

The minor soils are the well drained Fox and Hennepin soils on ridges and steep breaks, the well drained Rush soils in nearly level areas on terraces, the somewhat poorly drained Ceresco and Ceresco Variant soils on slight rises, and the very poorly drained Cohoctah Variant soils in depressions.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Erosion, flooding, and droughtiness are the main management concerns. The gently sloping Ockley soils are more susceptible to erosion if vegetation is removed.

These soils are well suited to trees.

The Moundhaven and Landes soils are generally unsuited to building site development and sanitary facilities because of the flooding. The Ockley soils are fairly well suited to building site development and well suited to sanitary facilities. The main limitation in areas of the Ockley soils is shrinking and swelling.

13. Jules-Landes-Armiesburg

Deep, nearly level, well drained, moderately fine textured to moderately coarse textured soils that formed in silty and loamy sediments; on flood plains

This map unit consists of soils on flood plains. Slopes range from 0 to 2 percent.

This map unit makes up about 2 percent of the county. It is about 30 percent Jules and similar soils, 29 percent Landes and similar soils, 12 percent Armiesburg soils, and 29 percent minor soils.

Typically, the Jules soils have a surface layer of dark brown silt loam that is underlain by brown and dark yellowish brown silt loam and very fine sandy loam.

Typically, the Landes soils have a surface soil of very dark grayish brown fine sandy loam and a subsoil of dark brown, brown, and dark yellowish brown fine sandy loam and sandy loam.

Typically, the Armiesburg soils have a surface soil of very dark grayish brown silty clay loam and a subsoil of dark brown and brown silty clay loam.

The minor soils are the very poorly drained Cohoctah Variant and Beaucoup soils in depressions and the somewhat poorly drained Ceresco soils on slight rises.

Most areas are used for cultivated crops. Some are used for hay or pasture. The soils are well suited to these uses. Flooding is the main management concern.

These soils are well suited to trees. Plant competition is a management concern.

These soils are generally unsuited to building site development and sanitary facilities because of the flooding.

Nearly Level and Gently Sloping Soils That Are Well Drained and Very Poorly Drained; on Terraces

These soils make up about 2 percent of the county. They are underlain by limestone bedrock. Most areas are used for pasture or are left idle. Some are used for corn, soybeans, or small grain. The limitations affecting sanitary facilities and building site development are severe.

14. Milton Variant-Millsdale-Mudlavia Variant

Shallow and moderately deep, nearly level and gently sloping, well drained and very poorly drained, medium textured soils that formed in silty residuum and in loamy and clayey-skeletal glacial outwash over bedrock; on terraces

This map unit consists of soils on knolls, in depressions, and on slight rises on terraces. Slopes range from 0 to 4 percent.

This map unit makes up about 2 percent of the county. It is about 29 percent Milton Variant soils, 20 percent Millsdale soils, 19 percent Mudlavia Variant soils, and 32 percent minor soils.

The well drained, nearly level and gently sloping Milton Variant soils are on knolls. Typically, they have a

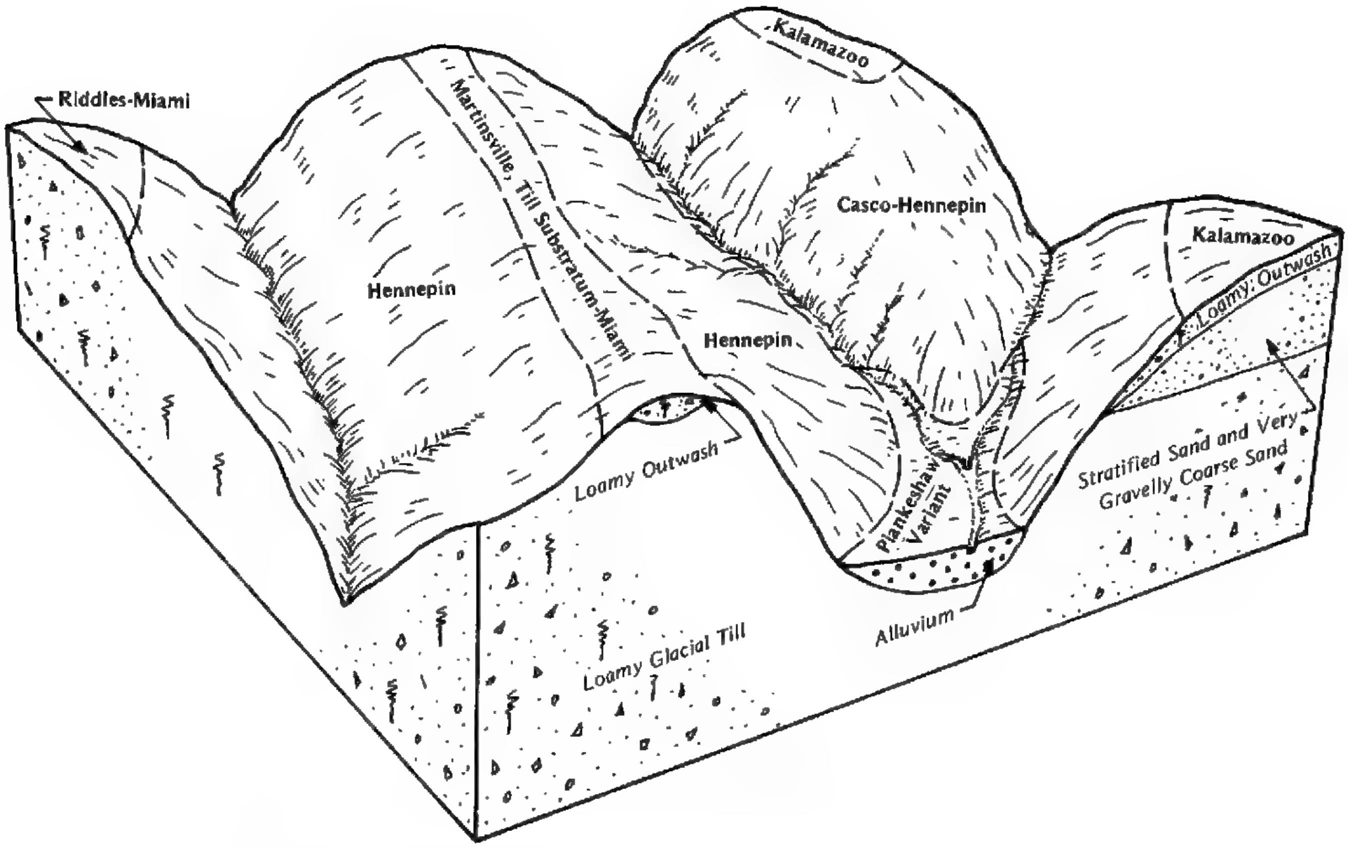


Figure 4.—Pattern of soils and parent material in the Hennepin-Casco map unit.

surface layer of brown channery silt loam and a subsoil of brown very channery silt loam.

The very poorly drained, nearly level Millsdale soils are in depressions. Typically, they have a surface layer of very dark grayish brown loam and a subsoil of dark gray and dark grayish brown, mottled clay loam and gravelly clay loam.

The well drained, nearly level Mudlavia Variant soils are on slight rises. Typically, they have a surface layer of dark brown gravelly loam and a subsoil of dark yellowish brown and brown very gravelly and extremely cobbly clay loam.

The minor soils are the excessively drained Coloma soils on ridges and knolls and the very poorly drained Westland and Palms Variant soils in depressions. The Westland soils have a shale substratum.

Most areas are used for cultivated crops. Some are used for hay or pasture or are left idle. The soils are fairly well suited to these uses. Droughtiness, rock fragments, a seasonal high water table, and ponding are the main management concerns.

These soils are fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are the main management concerns.

These soils are poorly suited to building site development and sanitary facilities because of the depth to bedrock, the ponding, a seasonal high water table, large stones, and seepage.

Steep and Very Steep Soils That Are Well Drained; on Breaks of Till Plains, Outwash Plains, and Terraces

These soils make up about 4 percent of the county. They are on steep and very steep slopes. Most areas are woodland. The limitations affecting sanitary facilities and building site development range from slight to severe.

15. Hennepin-Casco

Deep, steep and very steep, well drained, medium textured soils that formed in glacial till or glacial outwash; on breaks of till plains, outwash plains, and terraces

This map unit consists of soils on steep and very steep breaks on till plains, outwash plains, and terraces.

This map unit makes up about 4 percent of the county. It is about 68 percent Hennepin soils, 18 percent Casco soils, and 14 percent minor soils (fig. 4).

The Hennepin soils are on upland breaks. Typically, they have a surface layer of very dark grayish brown loam and a subsoil of yellowish brown and brown loam.

The Casco soils are on outwash plains and terrace breaks. Typically, they have a surface layer of dark brown loam and a subsoil of brown, dark brown, and dark reddish brown loam, sandy clay loam, and gravelly sandy clay loam.

The minor soils are the well drained Martinsville, Miami, and Riddles soils on ridges and knolls of till plains, the well drained Kalamazoo soils on ridges, knolls, and nearly level areas of outwash plains, and the well drained Piankeshaw Variant soils on alluvial fans. The Martinsville soils have a till substratum.

Most areas are woodland. The soils are suited to woodland use. The main management concerns are erosion and slope. These soils generally are unsuited to cultivated crops or to hay and pasture because of the slope.

These soils generally are unsuited to building site development and sanitary facilities because of the slope.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Fox sandy loam, 0 to 2 percent slopes, is a phase of the Fox series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Landes-Moundhaven complex, occasionally flooded, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Pits, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Descriptions, names, and delineations of soils in this soil survey do not always agree or fully join with those of adjoining counties published at an earlier date. Differences are a result of better knowledge of soils and of modification or refinement in soil series concepts, intensity of mapping, and extent of the soils within the survey area. Other differences may be caused by the range in slope allowed within the map unit of adjoining surveys. In some places small acreages of similar soils whose use and management are much the same were combined rather than mapped separately. In this county or in adjacent counties a map unit is sometimes too small to be delineated.

Soil Descriptions

AsB2—Alvin fine sandy loam, 2 to 8 percent slopes, eroded. This gently sloping, deep, well drained soil is on rises on outwash plains and till plains. Areas are elongated and are 5 to 20 acres in size.

In a typical profile, the surface layer is brown fine sandy loam about 9 inches thick. It contains dark

yellowish brown subsoil material. The subsoil is more than 80 inches thick. The upper part is dark yellowish brown, friable sandy loam and loamy sand. The lower part is yellowish brown and dark yellowish brown, friable sandy loam and loamy sand and is banded. In a few areas the surface layer is sandy loam. In some areas gravelly coarse sand is at a depth of less than 80 inches. In some places the subsoil has more clay and less sand, and in other places it has less clay. In some areas the slope is less than 2 or more than 8 percent.

Included with this soil in mapping are areas of the Ockley, Rush, and Kalamazoo soils on the lower parts of the landscape. These soils have more clay in the subsoil than the Alvin soil. Ockley and Rush soils formed in silty material and have a till substratum. Also included are areas where glacial till is within a depth of 60 inches. Included soils make up about 8 to 12 percent of the unit.

The Alvin soil has a moderate available water capacity. Permeability is moderate in the upper part of the subsoil and moderately rapid in the lower part. Organic matter content is moderately low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion.

Working this soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

This soil is suitable as a site for dwellings. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the moderate permeability in the upper part of the subsoil, this soil is moderately limited as a site for septic tank absorption fields. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderate permeability.

The land capability classification is IIe. The woodland ordination symbol is 4A.

At—Armiesburg silty clay loam, occasionally flooded. This nearly level, deep, well drained soil is on slight rises on flood plains. During the winter and early spring, it is subject to occasional flooding of brief duration. Areas are elongated and are parallel to streams. They are 10 to more than 80 acres in size.

In a typical profile, the surface soil is very dark grayish brown silty clay loam about 22 inches thick. The subsoil is dark brown and brown, firm silty clay loam about 43 inches thick. The underlying material to a depth of 80 inches is brown silt loam. In some areas the thickness of the dark surface layer is less than 10 or more than 22 inches. In other areas the surface layer has less clay. In some places the subsoil has less clay, and in other places the underlying material has more clay. In most places loamy material is at a depth of more than 80 inches. In some areas the surface soil

and subsoil have more sand. In other areas the slope is more than 2 percent.

Included with this soil in mapping are areas of the well drained Jules and Stonelick soils on the lower parts of the landscape. Jules soils have less clay in the subsoil than the Armiesburg soil. Stonelick soils have more sand and less clay in the subsoil than the Armiesburg soil. Also included are areas that are frequently flooded for long periods and areas of very poorly drained or somewhat poorly drained soils. Included soils make up about 5 to 10 percent of the unit.

The Armiesburg soil has a high available water capacity. Permeability is moderate. Organic matter content is moderate in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn and soybeans. Late planting or replanting is sometimes necessary because of flooding. Small grain that is seeded in fall or early spring may be damaged by floodwater. Levees help to control flooding. Crusting is also a problem. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to spring-plow, spring-chisel, and no-till cropping systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding is a hazard. Shallow-rooted legumes that are tolerant of flooding grow best. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, low strength, and frost action. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. Strengthening or replacing the base material with better suited material improves the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets reduces wetness and the potential for frost action.

The land capability classification is IIw. The woodland ordination symbol is 8A.

Ba—Beaucoup silty clay loam, rarely flooded. This nearly level, deep, very poorly drained soil is on narrow flood plains dissecting the till plains. During the winter and early spring, it is subject to rare flooding of brief duration and to ponding. Areas are elongated and are parallel to creeks and open ditches. They are dominantly about 50 to more than 100 acres in size.

In a typical profile, the surface layer is very dark gray silty clay loam about 11 inches thick. The subsoil is dark gray and gray, mottled, firm silty clay loam about 38 inches thick. The upper part of the underlying material is gray, mottled very fine sandy loam. The lower part to a depth of 65 inches is gray, mottled fine sandy loam and sandy loam. In some places sand and gravel are below a depth of 50 inches. In other places the surface layer is mucky silty clay loam or mucky silt loam. In a few places light colored overwash is at the surface. It is as much as 12 inches thick. In some areas the subsoil has more sand or more clay.

Included with this soil in mapping are small areas that are occasionally flooded. Also included are areas of somewhat poorly drained soils that have less clay and more sand in the surface soil and subsoil than the Beaucoup soil. Included soils make up about 6 to 10 percent of the unit.

The Beaucoup soil has a high available water capacity. Permeability is moderately slow. Organic matter content is high in the surface layer. Runoff is slow. The water table is at or above the surface during the winter and early spring. The surface layer becomes cloddy and hard to work if it is tilled when too wet.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn and soybeans. Ponding is a hazard, and wetness is a limitation. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by

ponding during the winter and early spring even if a drainage system has been established for row crops. Late planting or replanting is sometimes necessary because of the brief ponding. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. The ponding hinders the use of equipment. Machinery bogs down in ponded areas. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. Levees help to control flooding.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Water-tolerant species grow best. Ponding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding and the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding and low strength. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, constructing roadside ditches, and installing culverts reduce the wetness and improve the ability of the road to support vehicular traffic. Levees help to control flooding.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Bb—Beaucoup silt loam, frequently flooded. This nearly level, deep, very poorly drained soil is in depressions on flood plains. During the winter and spring, it is frequently flooded for brief periods. Areas are elongated and are parallel to creeks and rivers. They are dominantly about 10 to 25 acres in size.

In a typical profile, the surface layer is very dark grayish brown silt loam about 12 inches thick. The subsoil is about 28 inches thick. It is very dark gray and grayish brown, mottled, firm silty clay loam in the upper part and grayish brown, mottled, friable silt loam in the lower part. The upper part of the underlying material is grayish brown, mottled silt loam. The lower part to a depth of 60 inches is grayish brown, mottled very fine sandy loam and silty clay loam. In some places sand and gravel are below a depth of 50 inches. In other places the dark surface layer is less than 10 inches thick. In some areas the surface layer is mucky silt loam or mucky silty clay loam. In other areas the subsoil has more sand or less clay.

Included with this soil in mapping are small areas that are occasionally flooded. Also included are areas of somewhat poorly drained soils on rises. Some areas have not been drained and remain wet most of the year. Included soils make up about 8 to 15 percent of the unit.

The Beaucoup soil has a high available water capacity. Permeability is moderately slow. Organic matter content is high in the surface layer. Runoff is

slow. The water table is at or above the surface during the winter and spring.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is poorly suited to corn and soybeans. Flooding is a hazard, and wetness is a limitation. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by floodwater during the winter and spring even if a drainage system has been established for row crops. Late planting or replanting is sometimes necessary because of the brief flooding. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. The flooding hinders the use of equipment. Machinery bogs down in flooded areas. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. Levees help to control flooding.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for pasture. It is fairly well suited to hay. Water-tolerant species grow best. Flooding and frost heaving are hazards. The wetness is a limitation. Flooding can be controlled by levees. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding and the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, ponding, and low strength. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts reduce the wetness and improve the ability of the roads to support vehicular traffic. Levees help to control flooding.

The land capability classification is IVw. The woodland ordination symbol is 5W.

CaA—Camden silt loam, 0 to 1 percent slopes. This nearly level, deep, well drained soil is on slight rises on outwash plains. Areas are irregular in shape and are 3 to 100 acres in size.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 56 inches thick. The upper part is dark yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown, firm clay loam. The underlying material to a depth of 80 inches is brown loam stratified with thin layers of silt loam and sandy loam. In some places the silty material is more than 40 inches thick. In a few places the lower part of the subsoil has more than 10 percent gravel. In other places mottles are in the lower part of the subsoil. In a few areas the surface layer is darker. In a few places glacial till is within a depth of 60 inches. In other places the slope is more than 1 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Starks and Kendall soils in slight depressions. Also included are areas of the poorly

Figure 5.—Corn is a major crop on Camden silt loam, 0 to 1 percent slopes.

drained Patton soils in depressions. Included soils make up about 10 to 15 percent of the unit.

The Camden soil has a high available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is slow.

Nearly all areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain (fig. 5). Crusting is a problem. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to prevent crusting, improve tilth, increase the organic matter content, and improve the infiltration rate. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such

as orchardgrass and alfalfa, for hay or pasture. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which grazing periods are shortened during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by cutting, spraying, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is suitable for dwellings with basements. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material help to prevent the structural damage caused by shrinking and swelling.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the potential for frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic. The soil is suitable as a site for septic tank absorption fields.

The land capability classification is I. The woodland ordination symbol is 7A.

CaB2—Camden silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on rises and side slopes on outwash plains. Areas are irregular in shape and are 3 to 50 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. It contains about 20 percent dark yellowish brown subsoil material. The subsoil is about 55 inches thick. In sequence downward, it is dark yellowish brown, firm silty clay loam; brown, firm clay loam; brown, friable sandy loam; and dark yellowish brown, friable loam and fine sandy loam. The underlying material to a depth of 70 inches is yellowish brown sandy loam. In a few places glacial till is within a depth of 60 inches. In some places the lower part of the subsoil has mottles. In other places the silty material is thicker than 40 inches. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the somewhat poorly drained Starks and Kendall soils in swales and along drainageways and the poorly drained Patton soils in depressions. Also included are a few severely eroded areas of soils that have a more clayey surface layer than that of the Camden soil. Included soils make up about 10 to 15 percent of the unit.

The Camden soil has a high available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. Erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and

the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is suitable for dwellings with basements. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material help to prevent the structural damage caused by shrinking and swelling. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action. The soil is suitable as a site for septic tank absorption fields.

The land capability classification is IIe. The woodland ordination symbol is 7A.

CeG—Casco-Hennepin loams, 30 to 70 percent slopes. These steep and very steep, well drained soils are on terrace breaks. The Casco soil is shallow over very gravelly coarse sand, and the Hennepin soil is deep. The Casco soil is on the upper part of the side slopes, and the Hennepin soil is on the lower part. Areas are elongated and are 5 to more than 80 acres in size. They are about 50 percent Casco soil and 40 percent Hennepin soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Casco soil is dark brown loam about 3 inches thick. The subsoil is about 16 inches thick. The upper part is brown, firm loam and sandy clay loam, and the lower part is dark brown and dark reddish brown, firm gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. In some eroded areas the surface layer has more clay. In other areas it is gravelly. In a few areas very gravelly coarse sand is at a depth of more than 24 inches. In some places the subsoil has more clay. In other places the slope is less than 30 or more than 70 percent. Some areas are not a source of sand and gravel.

In a typical profile, the surface layer of the Hennepin soil is very dark grayish brown loam about 4 inches thick. The subsoil is brown, friable loam about 10 inches thick. The underlying material to a depth of 60 inches is grayish brown loam. In some eroded areas the surface layer has more clay. In some places the subsoil has more clay, and in other places it is mottled. In some areas loamy outwash material is over the glacial till. In other areas the solum is more than 20 inches thick. In places the slope is less than 30 or more than 70 percent.

Included with these soils in mapping are areas of the well drained Rush soils on the less sloping parts of the landscape. These included soils formed in silty material and have a thicker solum than the Casco and Hennepin soils. They make up about 10 percent of the unit.

The Casco soil has a low available water capacity. The Hennepin soil has a moderate available water capacity. Permeability is moderate in the subsoil of the Casco soil and very rapid in the underlying material. It is moderately slow in the Hennepin soil. Runoff is rapid on the Casco soil and very rapid on the Hennepin soil. Organic matter content is moderately low in the surface layer of both soils.

Most areas of these soils are used as woodland. The soils are generally unsuited to cultivated crops and to hay crops. They are poorly suited to grasses and legumes, such as orchardgrass and alfalfa, for pasture. Erosion and runoff are hazards, and the very steep slopes hinder the operation of equipment. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are poorly suited to trees. The slope is a limitation. The main management concerns are the erosion hazard, the equipment limitation, seedling mortality, and plant competition. Slippage often damages tree root systems in areas where the soil has layers of sand and gravel in the lower part. Logging roads, skid trails, and landings should be located on gentle grades. Water bars, culverts, and drop structures minimize erosion. Special logging methods, such as yarding the logs with a cable, may be needed because of the very steep slopes. The equipment limitation can

be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the slope, these soils are generally unsuitable as sites for dwellings, local roads, and sanitary facilities. Alternate sites should be selected.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Casco soil is 4R, and the one assigned to the Hennepin soil is 5R.

Cg—Ceresco fine sandy loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is on flood plains. During the winter and early spring, it is subject to occasional flooding of brief duration. Areas are irregular in shape or elongated and are parallel to creeks and streams. They are 5 to more than 50 acres in size.

In a typical profile, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is yellowish brown and brown, mottled, friable fine sandy loam about 21 inches thick. The upper part of the underlying material is brown, mottled loamy fine sand. The lower part to a depth of 60 inches is brown, mottled fine sandy loam and loamy fine sand. In some areas the surface layer is silt loam or very fine sandy loam. In a few areas the surface layer is a lighter color. In a few places gravelly coarse sand is within a depth of 60 inches, and in other places firm glacial till is within a depth of 60 inches. In places the subsoil has more clay and less sand.

Included with this soil in mapping are small areas of the well drained Landes and Landes Variant soils and the somewhat excessively drained Moundhaven soils on the higher parts of the landscape and the very poorly drained Cohoctah soils on the lower parts of the landscape. Also included are areas of soils that are well drained and do not have a dark surface layer and a few small areas of soils that are rarely flooded or frequently flooded. Included in the mouth of draws are areas of rarely flooded colluvial material. Included soils make up about 8 to 10 percent of the unit.

The Ceresco soil has a moderate available water capacity. Permeability is moderately rapid. Organic matter content is moderate in the surface layer. Runoff is very slow. The water table is at a depth of 1 to 2 feet during the winter and early spring.

Most areas of this soil are drained and used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn and soybeans. Flooding is a hazard, and wetness is a limitation. Late planting or replanting is sometimes necessary because of the flooding. Small grain that is seeded in fall or early spring may be damaged by floodwater even if a drainage system has been established for row crops. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Levees help to control flooding.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Flooding can be controlled by levees. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is fairly well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation and plant competition. The equipment limitation can be minimized by delaying

timber harvest until dry periods or until the soil is frozen. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding and frost action. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, constructing roadside ditches, and installing culverts help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IIw. The woodland ordination symbol is 4W.

Ck—Ceresco Variant fine sandy loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is on flood plains. During the winter and early spring, it is subject to occasional flooding of brief duration. Areas are irregular in shape or elongated and are parallel to creeks and streams. They are 5 to more than 100 acres in size.

In a typical profile, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 29 inches thick. The upper part is brown and dark grayish brown, mottled, friable fine sandy loam, and the lower part is dark grayish brown and gray, mottled, friable sandy loam. The upper part of the underlying material is gray, mottled sandy loam. The lower part to a depth of 60 inches is grayish brown very gravelly loamy coarse sand. In some areas the surface layer is silt loam, and in a few areas it has a lighter color. In places gravelly coarse sand is within a depth of 24 to 60 inches. In some places the subsoil has more clay and less sand. In other places firm glacial till is within a depth of 60 inches. Some areas are not a source of sand or gravel. A few small areas are rarely flooded or frequently flooded.

Included with this soil in mapping are small areas of the well drained Landes soils on the higher parts of the landscape and areas of the very poorly drained Cohoctah, gravelly substratum, soils in depressions. Also included are areas of soils that are well drained and do not have a dark surface layer. Included in the mouth of draws are areas of rarely flooded colluvial material. Included soils make up about 8 to 10 percent of the unit.

The Ceresco Variant soil has a moderate available water capacity. Permeability is moderately rapid in the subsoil and the upper part of the underlying material and very rapid in the lower part of the underlying material. Organic matter content is moderate in the surface layer. Runoff is very slow. The water table is at a depth of 1 to 2 feet during the winter and early spring.

Most areas of this soil are drained and used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn and soybeans. Flooding is a hazard, and wetness is a limitation. Late planting or replanting is sometimes necessary because of the flooding. Small grain that is seeded in fall or early spring may be damaged by floodwater even if a drainage system has been established for row crops. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Levees help to control flooding.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Flooding can be controlled by levees. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is fairly well suited to trees. The wetness is

a limitation. The main management concerns are the equipment limitation and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding and frost action. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, constructing roadside ditches, and installing culverts help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IIw. The woodland ordination symbol is 4W.

Cn—Cohoctah loam, occasionally flooded. This nearly level, deep, very poorly drained soil is in depressions on flood plains. From late fall through early spring, it is subject to occasional flooding of brief duration. Areas are elongated and are parallel to streams. They are 10 to more than 80 acres in size.

In a typical profile, the surface soil is very dark grayish brown loam about 15 inches thick. The subsoil is dark grayish brown, mottled, friable loam and fine sandy loam about 24 inches thick. The underlying material extends to a depth of at least 70 inches. In sequence downward, it is dark grayish brown, mottled sandy loam stratified with thin layers of loamy sand; very dark grayish brown, mottled fine sandy loam; very dark grayish brown, mottled sandy loam stratified with thin layers of loamy sand; and grayish brown, mottled loam that is stratified with thin layers of sandy loam. In some areas the dark surface layer is less than 10 inches thick, and in other areas the surface layer is lighter in color or is mucky silt loam or muck. In places the surface soil has more clay or sand. In some areas less clay is in the subsoil. In other areas the soil has more clay in the subsoil or the underlying material, or in both. In places calcareous glacial till is within a depth of 60 inches. In a few places the underlying material is gravelly within a depth of 60 inches.

Included with this soil in mapping are areas of the well drained Landes, Landes Variant, and Moundhaven soils on rises and the somewhat poorly drained Ceresco and Ceresco Variant soils on the slightly higher parts of the landscape. Included soils make up about 8 to 15 percent of the unit.

The Cohoctah soil has a high available water capacity. Permeability is moderately rapid. Organic matter content is high in the surface layer. Runoff is very slow. The water table is at or near the surface from late fall through early spring.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn and soybeans. Flooding is a hazard, and excess water is a limitation. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by floodwater during the winter and early spring even if a drainage system has been established for row crops. Late planting or replanting is sometimes necessary because of the brief flooding. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. Levees help to control flooding.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain good soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Flooding can be controlled by levees. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer

minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities and is severely limited as a site for local roads. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, constructing roadside ditches, and installing culverts reduce the wetness and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IIw. The woodland ordination symbol is 3W.

Cp—Cohoctah loam, gravelly substratum, occasionally flooded. This nearly level, deep, very poorly drained soil is in drainageways that dissect till plains. From late fall through early spring, it is subject to occasional flooding of brief duration. Areas are elongated and are parallel to streams. They are 10 to more than 50 acres in size.

In a typical profile, the surface layer is very dark grayish brown loam about 10 inches thick. The underlying material extends to a depth of at least 60 inches. In sequence downward, it is very dark grayish brown, mottled loam; grayish brown, mottled loam and sandy loam; dark grayish brown, mottled loam; very dark grayish brown, mottled sandy loam; and grayish brown very gravelly loamy coarse sand. In some areas the dark surface layer is less than 10 inches thick, and in other areas the surface layer is lighter in color or is mucky silt loam or muck. In some places the surface soil has more clay or sand. In other places less clay is in the subsoil or more clay is in the subsoil or the underlying material, or both. In places calcareous glacial till is within a depth of 60 inches. In a few places the underlying material is not gravelly within a depth of 60 inches. Some places are not a source of sand or gravel.

Included with this soil in mapping are areas of the well drained Landes Variant and Moundhaven soils on rises and the somewhat poorly drained Ceresco Variant soils on the slightly higher parts of the landscape. Also included are well drained and moderately well drained soils that do not have a dark surface layer. Included soils make up about 8 to 15 percent of the unit.

The Cohoctah soil has a moderate available water capacity. Permeability is moderately rapid in the subsoil and the upper part of the underlying material and very rapid in the lower part of the underlying material. Organic matter content is high in the surface layer. Runoff is very slow. The water table is at or above the surface from late fall through early spring.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn and soybeans. Flooding is a hazard, and wetness is a limitation. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by floodwater during the winter and early spring even if a drainage system has been established for row crops. Late planting or replanting is sometimes necessary because of the brief flooding. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. In some areas no drainage outlets are available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. Levees help to control flooding.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain good soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain

soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Flooding can be controlled by levees. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding and the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, the ponding, and frost action. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts reduce the wetness and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets also reduces the wetness and the potential for frost action.

The land capability classification is IIw. The woodland ordination symbol is 2W.

Cr—Cohoctah Variant very fine sandy loam, frequently flooded. This nearly level, deep, very poorly drained soil is in depressions on flood plains. From late fall through spring, it is frequently flooded for brief periods. Areas are elongated and are parallel to streams. They are 5 to more than 40 acres in size.

In a typical profile, the surface layer is very dark grayish brown very fine sandy loam about 10 inches thick. The subsoil is dark grayish brown, mottled, friable fine sandy loam and sandy loam about 22 inches thick. The upper part of the underlying material is dark grayish brown, mottled sandy loam and fine sandy loam. The next part is dark grayish brown loamy sand stratified with thin layers of sandy loam. The lower part to a depth of 60 inches is dark grayish brown fine sandy loam. In some areas the dark surface layer is less than 10 inches thick. In other areas the surface soil has more clay or is mucky loam or muck. In some places less clay is in the subsoil, and in other places more clay is in the subsoil or the underlying material, or both. In places calcareous glacial till is within a depth of 60 inches. In a few places the underlying material is gravelly within a depth of 60 inches.

Included with this soil in mapping are areas of the well drained Landes Variant and somewhat excessively drained Moundhaven soils on the higher parts of the landscape. Included soils make up about 8 to 15 percent of the unit.

The Cohoctah Variant soil has a moderate available water capacity. Permeability is moderately rapid. Organic matter content is high in the surface layer. Runoff is very slow. The water table is at or above the surface from late fall through spring.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is fairly well suited to corn and soybeans. Flooding is a hazard, and wetness is a limitation. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by floodwater during the winter and early spring even if a drainage system has been established for row crops. Late planting or replanting is sometimes necessary because of the flooding. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. The frequent flooding hinders the use of equipment. Machinery bogs down in flooded areas. Levees help to control flooding. In some areas no drainage outlets are available. If an outlet is

available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain good soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The flooding and frost heaving are hazards, and the wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Flooding can be controlled by levees. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable to provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding and the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, the ponding, and frost action. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts reduce the wetness and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets also reduces the wetness and the potential for frost action.

The land capability classification is IIIw. The woodland ordination symbol is 3W.

CtB—Coloma loamy sand, 2 to 10 percent slopes. This gently sloping and moderately sloping, deep, excessively drained soil is on rises on stream terraces. Areas are long and narrow or irregular in shape. They are dominantly about 3 to more than 20 acres in size.

In a typical profile, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown and light yellowish brown, loose loamy sand about 33 inches thick. The subsoil to a depth of 80 inches is light yellowish brown and yellowish brown, loose loamy sand that has bands of dark brown, friable sandy loam. In some areas the slope is less than 2 or more than 10 percent. In some places, the bands are more than 6 inches thick or the subsoil does not have bands. In other places the uppermost bands are above a depth of 40 inches or below a depth of 60 inches. In some areas the soil is dominantly fine sand.

Included with this soil in mapping are small areas of the well drained Fox, Mudlavia, and Ormas soils on the lower parts of the landscape. These soils have more clay in the subsoil than the Coloma soil. Included soils make up about 10 to 15 percent of the unit.

The Coloma soil has a low available water capacity. Permeability is rapid. Organic matter content is low in the surface layer. Runoff is medium.

Most areas of this soil are used for hay or pasture. A few are used for cultivated crops or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness and soil blowing are hazards. Irrigation helps to overcome the droughtiness. The hazard of soil blowing can be reduced by windbreaks, a system of conservation tillage that leaves protective amounts of crop residue on the surface (fig. 6), cover crops, green manure crops, or permanent vegetation. Working the soil at the correct moisture content minimizes compaction and helps to maintain good soil structure. A system of conservation tillage that leaves

Figure 6.—Soil blowing is a hazard in many areas of Coloma loamy sand, 2 to 10 percent slopes. The area in the foreground is protected by corn stubble.

crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for pasture and is fairly well suited to hay. Soil blowing and droughtiness are hazards. A permanent cover of grasses and legumes helps to control soil blowing. Droughtiness can be controlled by irrigation. Overgrazing reduces plant density and hardiness and results in erosion. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control soil blowing, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Droughtiness is a hazard. The main management concerns are the equipment limitation and seedling mortality. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable

because they provide shade and protection for seedlings. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

This soil is suitable as a site for dwellings and local roads and streets. It is severely limited as a site for septic tank absorption fields because of poor filtering qualities. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity. Enlarging the absorption field or installing deep wells minimizes the adverse affects of the poor filtering capacity.

The land capability classification is IVs. The woodland ordination symbol is 4S.

CvA—Crosby silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on slight rises on terraces. Areas are irregular in shape and are 10 to 30 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 23 inches thick. The upper part is grayish brown, mottled, firm silty clay loam, and the lower part is brown, firm clay and clay loam. The underlying material to a depth of 60 inches is yellowish brown loam. Some areas have a thinner or thicker deposit of silty material. In places the subsoil has less clay. In some areas the surface layer is dark, and in other areas it is loam or sandy loam. In some places the slope is more than 2 percent. In other places the underlying material is sandy loam till. In some areas the upper part of the subsoil is not mottled, and in other areas the lower part of the subsoil is stratified loamy sand, sandy loam, silt loam, and loam. In a few places the content of gravel is as much as 20 percent in the lower part of the subsoil.

Included with this soil in mapping are areas of the well drained Martinsville, till substratum, and Miami soils on ridges; some very poorly drained soils in swales and depressions; and the somewhat poorly drained Fincastle soils in the less sloping areas. Fincastle soils have a thicker silty layer than the Crosby soil. Also included are severely eroded areas that have more clay in the surface layer than the Crosby soil. Included soils make up about 8 to 15 percent of the unit.

The Crosby soil has a moderate available water capacity. Permeability is slow. Organic matter content is moderately low in the surface layer. Runoff is slow. The water table is within 1 to 3 feet of the surface during the winter and early spring.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation. Crusting is a problem. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to a fall-chisel cropping system.

If drained, this soil is well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. They are better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. The wetness is a limitation, and frost heaving is a hazard. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, this soil is severely limited as a site for dwellings. A drainage system can help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to

suitable outlets reduces the potential for frost action.

Because of the moderately slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability. Installing perimeter drains around the absorption field helps to lower the water table.

The land capability classification is IIw. The woodland ordination symbol is 4A.

CwB—Crosby-Fincastle silt loams, 1 to 3 percent slopes. These gently sloping, deep, somewhat poorly drained soils are on slight rises on till plains. The Crosby soil is in the more sloping areas, and the Fincastle soil is in the less sloping areas. Areas are irregular in shape and are 5 to more than 50 acres in size. They are about 50 percent Crosby soil and 35 percent Fincastle soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Crosby soil is brown silt loam about 8 inches thick. The subsoil is about 19 inches thick. The upper part is brown and dark yellowish brown, mottled, firm silty clay loam; the next part is dark yellowish brown, mottled, firm clay loam; and the lower part is brown, mottled, firm loam. The underlying material to a depth of 60 inches is brown loam. In some areas the subsoil has more clay. In places the slope is more than 3 percent. In some places the surface layer is dark, and in other places it is loam or sandy loam. In some areas the upper part of the subsoil is not mottled. Some areas have less than 24 or more than 40 inches of silty material.

In a typical profile, the surface layer of the Fincastle soil is brown silt loam about 8 inches thick. The subsoil is about 44 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay loam and silt loam; the next part is brown, mottled, firm clay loam; and the lower part is brown, mottled, friable loam. The underlying material to a depth of 60 inches is brown loam. In places the subsoil has less clay. In some areas the slope is more than 3 percent. In other areas the silty material is less than 24 or more than 40 inches thick.

Included with these soils in mapping are areas of the well drained Miami soils on ridges and knolls, the very poorly drained Cyclone soils in depressions, and the somewhat poorly drained Starks soils in positions on the landscape similar to or slightly lower than the Crosby and Fincastle soils. Starks soils are underlain by stratified outwash. Included soils make up about 15 percent of the unit.

The Crosby soil has a moderate available water capacity. The Fincastle soil has a high available water capacity. Permeability is slow in the Crosby soil. It is moderate in the subsoil of the Fincastle soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, these soils are well suited to corn, soybeans, and small grain. Erosion and runoff are hazards, and wetness is a limitation. Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Excess water can be removed by surface drains, subsurface drains, or a combination of these.

Working these soils at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to fall-chisel and ridge-till cropping systems.

If drained, these soils are well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. They are better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. Erosion, runoff, and frost heaving are hazards, and the wetness is a limitation. Overgrazing reduces plant density and hardiness and results in erosion. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition

is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, these soils are severely limited as sites for dwellings. A drainage system can help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of frost action and low strength, these soils are severely limited as sites for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the moderately slow permeability and the wetness, these soils are severely limited as sites for septic tank absorption fields. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability. Installing perimeter drains around the absorption field helps to lower the water table.

The land capability classification is IIe. The woodland ordination symbol is 4A.

CyB—Crosier-Whitaker, till substratum, complex, 1 to 3 percent slopes. These gently sloping, deep, somewhat poorly drained soils are on slight rises on till plains. The Crosier soil is in the more sloping areas, and the Whitaker soil is in the less sloping areas. Areas are irregular in shape and are 5 to more than 50 acres in size. They are about 45 percent Crosier soil and 40 percent Whitaker soil that has a till substratum. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Crosier soil is brown loam about 9 inches thick. The subsoil is dark yellowish brown, mottled, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown and yellowish brown loam. In some areas the subsoil has more clay, and in other areas it is not mottled. In places the slope is more than 3 percent. In some places the surface layer is dark, and in other places it is silt loam or sandy loam.

In a typical profile, the surface layer of the Whitaker soil is dark brown silt loam about 9 inches thick. The subsoil is about 44 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay loam and clay loam; the next part is dark yellowish brown, mottled, firm loam; and the lower part is dark yellowish brown, mottled, friable loamy sand stratified with sandy loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the subsoil has less clay. In other places glacial till is at a depth of more than 60 inches. In some areas the slope is more than 3 percent. In other areas the silty material is more than 24 inches thick.

Included with these soils in mapping are areas of the well drained Riddles and Miami soils on ridges and knolls and the very poorly drained Mahalasville and Treaty soils in depressions. Included soils make up about 15 percent of the unit.

The Crosier soil has a moderate available water capacity. The Whitaker soil has a high available water capacity. Permeability is moderately slow in the Crosier soil. It is moderate in the subsoil of the Whitaker soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, these soils are well suited to corn, soybeans, and small grain. Erosion and runoff are hazards, and wetness is a limitation. Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Working the soils at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to fall-chisel and ridge-till cropping systems.

If drained, these soils are well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. They are better suited to deep-rooted

legumes, such as alfalfa, than to shallow-rooted legumes. Erosion, runoff, and frost heaving are hazards, and the wetness is a limitation. Overgrazing reduces plant density and hardiness and results in erosion. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, these soils are severely limited as sites for dwellings. A drainage system can help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of frost action and low strength, these soils are severely limited as sites for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets also helps to prevent this damage.

Because of the moderately slow permeability and the wetness, these soils are severely limited as sites for septic tank absorption fields. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability. Installing perimeter drains around the absorption field helps to lower the water table.

The land capability classification is IIe. The woodland ordination symbol is 4A.

Cz—Cyclone silty clay loam. This nearly level, deep, poorly drained soil is in broad, depressional areas on till plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape and are 5 to more than 150 acres in size.

In a typical profile, the surface soil is very dark gray silty clay loam about 12 inches thick. The subsoil is about 47 inches thick. The upper part is dark gray and dark grayish brown, mottled, firm silty clay loam; the next part is grayish brown, mottled, firm silty clay loam; and the lower part is brown, mottled, friable loam. The underlying material to a depth of 80 inches is brown and yellowish brown loam. In some areas the dark surface layer is less than 10 inches thick. In other areas the surface layer is lighter in color. Some areas have a mucky silt loam surface layer. Other areas have a thinner deposit of silty material. In some places less clay is in the subsoil, the underlying material, or both. In other places, the glacial till is deeper and the underlying material is glacial outwash. In some areas carbonates or firm glacial till are at a depth of 40 inches. In some places the silty material is more than 60 inches thick.

Included with this soil in mapping are areas of the somewhat poorly drained Fincastle, Kendall, and Starks soils on slight rises. Included soils make up about 8 to 15 percent of the unit.

The Cyclone soil has a high available water capacity. Permeability is moderate in the subsoil and moderately slow in the underlying material. Organic matter content is high in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface during the winter and early spring.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Shallow surface drains and subsurface drains that have adequate outlets can remove the excess water. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, soil aeration, the infiltration rate, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is the main limitation, and ponding and frost heaving are hazards. A drainage system increases forage yields. Even if subsurface and

shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the soil, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which grazing periods are shortened during the summer help to keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of low strength, the ponding, and frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness and help to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

FaA—Fincastle-Starks silt loams, 0 to 1 percent slopes. These nearly level, deep, somewhat poorly drained soils are on slight rises on flat till plains. The Fincastle soil is in the higher areas, and the Starks soil is in the lower areas. Areas are irregular in shape and are 5 to more than 100 acres in size. They are about 55 percent Fincastle soil and 30 percent Starks soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Fincastle soil is dark brown silt loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is grayish brown, mottled, firm silty clay loam; the next part is dark yellowish brown, mottled, firm silty clay loam and clay loam; and the lower part is brown, mottled, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the subsoil has less clay. In other places it has less silt and more sand. In some areas the silty material is less than 24 inches thick. In other areas the slope is more than 1 percent.

In a typical profile, the surface layer of the Starks soil is dark grayish brown silt loam about 10 inches thick. The subsoil is about 36 inches thick. The upper part is brown, mottled, firm silty clay loam, and the lower part is brown, mottled, friable loam and fine sandy loam. The upper part of the underlying material is brown, mottled silt loam stratified with loamy sand. The lower part to a depth of about 60 inches is brown, mottled loam stratified with loamy fine sand. In some places the subsoil has less clay. In other places it has less silt and more sand. In some areas the silty material is less than 24 inches thick. In other areas the slope is more than 1 percent.

Included with these soils in mapping are areas of the moderately well drained Rockfield soils on slight rises and knolls, the somewhat poorly drained Crosby and Kendall soils on slight rises, the poorly drained Cyclone soils in narrow depressions, and the moderately well drained Williamstown soils along drainageways and on knolls. Crosby soils are shallower to glacial till than the Fincastle and Starks soils. Kendall soils have a mantle of silty material that is thicker than that of the Fincastle and Starks soils and are underlain by glacial outwash. Also included are areas of well drained soils. Included soils make up about 15 percent of the unit.

The Fincastle and the Starks soils have a high available water capacity. Permeability is moderate in the subsoil of the Fincastle soil and moderately slow in the underlying material. It is moderate in the Starks soil. Organic matter content is moderately low in the surface layer of both soils. Runoff is slow. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of these soils are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, these soils are well suited to corn, soybeans, and small grain. Wetness is the main limitation. Crusting is a problem. The wetness hinders

normal root growth, resulting in a shallow root zone. Subsurface drains can remove excess water. Open ditches are needed in some places for subsurface drain outlets. Working the soils at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, soil aeration, the infiltration rate, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to fall-chisel and ridge-till cropping systems.

If drained, these soils are well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. They are better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. The wetness is a limitation, and frost heaving is a hazard. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, these soils are severely limited as sites for dwellings. Subsurface drains can help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table.

Because of low strength and frost action, these soils are severely limited as sites for local roads and streets. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action.

Because of the wetness in both soils and the moderately slow permeability of the Fincastle soil, these soils are severely limited as sites for septic tank absorption fields. Installing perimeter drains around the absorption field helps to lower the water table. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability.

The land capability classification is IIw. The woodland ordination symbol is 4A.

FbB—Fincastle-Starks silt loams, 1 to 3 percent slopes. These gently sloping, deep, somewhat poorly drained soils are on rises on till plains. The Fincastle soil is in the higher areas, and the Starks soil is in the lower areas. Areas are irregular in shape and are 5 to more than 50 acres in size. They are about 65 percent Fincastle soil and 20 percent Starks soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Fincastle soil is brown silt loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay loam and clay loam, and the lower part is brown, mottled, friable loam. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil has less clay. In other places it has less silt and more sand. In some areas the slope is more than 3 percent. In other areas the silty material is less than 24 inches thick.

In a typical profile, the surface layer of the Starks soil is brown silt loam about 9 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is dark grayish brown and brown, mottled, firm silty clay loam; dark yellowish brown, mottled, firm silty clay loam; dark yellowish brown, mottled, firm clay loam stratified with thin layers of sandy loam; and dark yellowish brown, mottled, firm silty clay loam and clay loam stratified with thin layers of silty clay loam. The underlying material to a depth of about 70 inches is brown loam, loamy sand, and sandy loam. In some places the subsoil has less clay. In other places it has less silt and more sand. In some areas the silty material is less than 24 inches thick. In other areas the slope is more than 3 percent.

Included with these soils in mapping are areas of the moderately well drained Rockfield soils on slight rises and knolls, the somewhat poorly drained Crosby and Kendall soils on slight rises, the poorly drained Cyclone soils in narrow depressions, and the moderately well drained Williamstown soils along drainageways and on knolls. Crosby soils are shallower to glacial till than the Fincastle and Starks soils. Kendall soils have a mantle of silty material that is thicker than that of the Fincastle and Starks soils and are underlain by glacial outwash. Also included are areas of well drained soils. Included

soils make up about 15 percent of the unit.

The Fincastle and the Starks soils have a high available water capacity. Permeability is moderate in the subsoil of the Fincastle soil and moderately slow in the underlying material. It is moderate in the Starks soil. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of these soils are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, these soils are well suited to corn, soybeans, and small grain. Erosion and runoff are hazards, and wetness is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Excess water can be removed by surface drains, subsurface drains, or a combination of these.

Working these soils at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to fall-chisel and ridge-till cropping systems.

If drained, these soils are well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. They are better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. Erosion, runoff, and frost heaving are hazards, and the wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, these soils are severely limited as sites for dwellings. Subsurface drains can help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of low strength and frost action, these soils are severely limited as sites for local roads and streets. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action. Conveying runoff to suitable outlets also helps to prevent this damage.

Because of the wetness in both soils and the moderately slow permeability of the Fincastle soil, these soils are severely limited as sites for septic tank absorption fields. Installing perimeter drains around the absorption field helps to lower the water table. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 4A.

FsA—Fox sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces. It is moderately deep to sand and very gravelly coarse sand. Areas are elongated and are 20 to 50 acres in size.

In a typical profile, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable gravelly sandy loam, and the lower part is brown and dark reddish brown, firm gravelly clay loam. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. In some areas the surface layer is gravelly or cobbly or is darker. In other areas the subsoil has less clay or is shallow to calcareous sand and very gravelly coarse sand. In some places the soil has more

clay in the subsoil, the underlying material, or both. In other places the subsoil has gray mottles. In some areas calcareous glacial till is within a depth of 60 inches. In other areas the slope is more than 2 percent. In some places bedrock is within a depth of 60 inches. In other places the subsoil extends to a depth of more than 40 inches. Some places are not a source of sand and gravel.

Included with this soil in mapping are small areas of the excessively drained Coloma soils and the well drained Ockley and Ormas soils, which are more sloping than the Fox soil. Coloma soils have lamellae in the subsoil. Ockley and Ormas soils are deeper to sand and gravel than the Fox soil. Included soils make up about 5 to 15 percent of the unit.

The Fox soil has a low available water capacity. Permeability is moderate in the solum and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Droughtiness is a hazard unless an irrigation system is used. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Droughtiness is a hazard unless an irrigation system is used. Drought-tolerant species grow best. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is suitable for dwellings with basements. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material helps to prevent the structural damage caused by shrinking and swelling.

Because of frost action and the shrink-swell potential, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of poor filtering qualities, this soil is severely limited as a site for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity. Enlarging the absorption field and installing deep wells also minimize the adverse effects of the poor filtering capacity.

The land capability classification is IIs. The woodland ordination symbol is 4A.

FsB2—Fox sandy loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on rises and side slopes on terraces. It is moderately deep to sand and very gravelly coarse sand. Areas are irregular in shape or elongated and are 3 to 30 acres in size.

In a typical profile, the surface layer is brown sandy loam about 7 inches thick. It contains about 15 percent dark brown subsoil material. The subsoil is dark brown, firm gravelly clay loam about 24 inches thick. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. In some areas the surface layer is gravelly or cobbly. In other areas it has more clay. In places the subsoil has less clay or has gray mottles. In some places the silty material is as much as 20 inches thick. In other places the soil has more clay in the subsoil, the underlying material, or both. In some areas sand and gravelly sand are at a depth of less than 20 inches. In other areas calcareous glacial till is within a depth of 60 inches. In places the slope is less than 2 or more than 6 percent. Some areas are not a source of sand and gravel.

Included with this soil in mapping are the excessively drained Coloma soils and the well drained Ockley and Ormas soils on ridges and knolls. Coloma soils are

sandy throughout. Ockley soils are deeper to sand and gravel than the Fox soil. Ormas soils are sandy in the upper part and are deeper to sand and very gravelly coarse sand than the Fox soil. Included soils make up about 5 to 15 percent of the unit.

The Fox soil has a low available water capacity. Permeability is moderate in the subsoil and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Droughtiness, erosion, and runoff are hazards. An irrigation system can overcome the adverse effects of droughtiness. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion.

Working this soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Erosion, droughtiness, and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. An irrigation system can overcome the adverse effects of droughtiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is suitable for dwellings with basements. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material help to prevent the structural damage caused by shrinking and swelling. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of frost action and the shrink-swell potential, this soil is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of poor filtering qualities, this soil is severely limited as a site for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity. Enlarging the absorption field or installing deep wells minimizes the adverse effects of the poor filtering capacity.

The land capability classification is IIe. The woodland ordination symbol is 4A.

FtC3—Fox gravelly clay loam, 6 to 15 percent slopes, severely eroded. This moderately sloping and strongly sloping, well drained soil is on side slopes on terraces. It is moderately deep to sand and very gravelly coarse sand. Areas are elongated and are 3 to 10 acres in size.

In a typical profile, the surface layer is brown gravelly clay loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part is brown, firm gravelly clay loam and gravelly sandy clay loam, and the lower part is reddish brown, friable gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. In some areas the surface layer is cobbly or has less clay. In other areas the subsoil has less clay. In some places the soil has more clay in the subsoil, the underlying material, or both. In other places calcareous glacial till is within a depth of 60 inches. In some areas the silty material is over sand and very gravelly coarse sand. In other areas

calcareous sand and very gravelly coarse sand are at a depth of less than 10 inches. In places the slope is less than 6 or more than 15 percent. Some areas are not a source of sand and gravel.

Included with this soil in mapping are the well drained Ockley soils in nearly level areas, on ridges, and on knolls and some very poorly drained soils in depressions. Ockley soils are deeper to sand and very gravelly coarse sand than the Fox soil. Included soils make up about 5 to 15 percent of the unit.

The Fox soil has a low available water capacity. Permeability is moderate in the subsoil and very rapid in the underlying material. Organic matter content is low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion, droughtiness, and runoff are hazards. Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for pasture. It is fairly well suited to hay. Erosion, droughtiness, frost heaving, and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. An irrigation system can overcome the adverse effects of droughtiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the slope, this soil is moderately limited as a site for dwellings with basements. It is moderately limited as a site for dwellings without basements because of the slope and the shrink-swell potential. The buildings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material help to prevent the structural damage caused by shrinking and swelling. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of low strength, this soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of poor filtering qualities, this soil is severely limited as a site for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity.

The land capability classification is IVe. The woodland ordination symbol is 4A.

HkG—Hennepin loam, 30 to 70 percent slopes. This steep and very steep, deep, well drained soil is on terraces and upland breaks on outwash plains, along flood plains, and on the sides of ravines dissecting the till plains. Slopes are 100 to 200 feet long. Areas are 5 to more than 100 acres in size.

In a typical profile, the surface layer is very dark grayish brown loam about 4 inches thick. The subsoil is yellowish brown and brown, friable loam about 12 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places, slippage has taken place and no soil profile is developed. In other places the slope is less than 30 or more than 70 percent.

Included with this soil in mapping are small areas of the well drained Casco soils. These soils are in positions on the landscape similar to those of the Hennepin soil. They have more very gravelly coarse sand than the Hennepin soil. Also included are a few

small areas where the upper part of the subsoil has formed in loamy outwash and the underlying glacial till and some areas where the soil has thin layers of sand and gravel or has hard chunks of calcium carbonate-bonded sand and gravel that are as much as 3 feet in diameter. Included soils make up about 10 to 15 percent of the unit.

The Hennepin soil has a moderate available water capacity. Permeability is moderately slow. Organic matter content is moderately low in the surface layer. Runoff is very rapid.

Most areas of this soil are used as woodland. A few are used for pasture.

Because of the slope, this soil is generally unsuited to crops and to grasses and legumes for hay. It is poorly suited to pasture. The best suited pasture species are orchardgrass and alfalfa. Erosion and runoff are hazards. Operating some types of equipment on these steep and very steep slopes can be hazardous. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which grazing periods are shortened during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is poorly suited to trees. The slope is a limitation. The main management concerns are the erosion hazard, the equipment limitation, and plant competition. Slippage often damages tree root systems in some areas where the soil has layers of sand and gravel in the lower part. Logging roads, skid trails, and landings should be located on gentle grades. Water bars, culverts, and drop structures minimize erosion. Special logging methods, such as yarding the logs with a cable, may be needed because of the slope. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the slope, this soil is generally unsuitable as a site for dwellings, local roads, and sanitary facilities. Alternative sites should be selected.

The land capability classification is VIIe. The woodland ordination symbol is 5R.

HnG—Hennepin-Rock outcrop complex, 30 to 90 percent slopes. This map unit occurs as areas of a steep and very steep, deep, well drained Hennepin soil intermingled with areas of Rock outcrop. The unit is on upland breaks on outwash plains, along flood plains, and on the sides of ravines dissecting the till plains. The Hennepin soil typically is on the upper part of the slope breaks. Slopes are dominantly 100 to 200 feet long. Areas range from 10 to more than 50 acres in size. Most are about 55 percent Hennepin soil and 35 percent Rock outcrop. The Hennepin soil and Rock outcrop occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Hennepin soil is very dark grayish brown loam about 4 inches thick. The subsoil is dark brown and brown, friable loam about 12 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some places, slippage has occurred and no soil profile has developed. In other places the slope is less than 30 percent.

The Rock outcrop is dominantly very pale brown shale (fig. 7). It is dolomite and limestone, however, in some areas near Delphi and the lower reaches of Deer Creek.

Included with the Hennepin soil and Rock outcrop in mapping are small areas of the well drained Casco soils. These soils are in positions on the landscape similar to those of the Hennepin soil. They have more very gravelly coarse sand than the Hennepin soil. Also included are areas where the soil has thin layers of sand and gravel, seepy spots on side slopes, and some areas where soil material has sloughed over the bedrock and a shallow soil has formed. Included soils make up about 10 percent of the unit.

The Hennepin soil has a moderate available water capacity. Permeability is moderately slow. Organic matter content is moderate in the surface layer. Runoff is very rapid.

Most areas are used as woodland. The Rock outcrop generally is bare. Because of the slope, this map unit is generally unsuited to crops and to grasses and legumes for hay. It is poorly suited to pasture. The best suited pasture species are orchardgrass and alfalfa. Erosion and runoff are hazards. Operating some types of equipment on these steep and very steep slopes can be

Figure 7.—Exposed shale in a wooded area of Hennepin-Rock outcrop complex, 30 to 90 percent slopes.

hazardous. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which grazing periods are shortened during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This map unit is poorly suited to trees. The slope is a limitation. The main management concerns are the erosion hazard, the equipment limitation, and plant

competition. Slippage often damages tree root systems in areas where the soil has layers of sand and gravel in the lower part. Logging roads, skid trails, and landings should be located on gentle grades. Water bars, culverts, and drop structures minimize erosion. Special logging methods, such as yarding the logs with a cable, may be needed because of the slope. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the slope, this map unit is generally unsuitable as a site for dwellings, local roads, and sanitary facilities. Alternative sites should be selected.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Hennepin soil is 5R.

Hw—Houghton muck, drained. This nearly level, deep, very poorly drained soil is in depressions on outwash plains, terraces, and till plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape or circular and are 3 to 40 acres in size.

In a typical profile, the surface layer is black muck about 10 inches thick. The organic material extends to a depth of more than 60 inches. It is black, friable muck in the upper part and dark brown, friable muck in the lower part. In some places coprogenous earth or marl is within a depth of 51 inches.

Included with this soil in mapping are areas of the poorly drained Pella soils and the very poorly drained Milford soils on slight rises. Milford soils do not have muck in the profile. Also included are the very poorly drained Palms and Wallkill soils in the higher areas. Palms soils do not have as thick a muck layer as that of the Houghton soil. Wallkill soils do not have a muck surface layer. Some undrained areas have a water table near or above the surface most of the year. Included soils make up about 5 to 15 percent of the unit.

The Houghton soil has a very high available water capacity. Permeability is moderately slow to moderately rapid. Organic matter content is very high in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface from late fall through early spring.

Most areas of this soil are drained and are used for cultivated crops. Some are used for pasture or woodland. Undrained areas provide habitat for wetland wildlife.

If drained, this soil is fairly well suited to corn and soybeans. Wetness is the main limitation, and ponding is a hazard. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established for row crops. The wetness and ponding can hinder the use of farm equipment. Open ditches, subsurface drains and outlets, pumps, or a combination of these can remove excess water. Overdrainage can result in accelerated subsidence of the muck. Raising the water table during fallow periods slows the rate of subsidence. In large areas that are not protected when they are drained and cultivated, soil blowing is a hazard. It can be controlled by a system of conservation tillage that leaves protective amounts of crop residue on the surface. The soil is well suited to spring plowing.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. It is best suited to water-tolerant species. The wetness is the main limitation, and soil blowing, frost heaving, and ponding are hazards. A permanent cover of grasses and legumes helps to control soil blowing. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to maintain good plant density and hardiness and keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is

controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads and streets because of the ponding, the subsidence, and frost action. Removing the unstable material, constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Jr—Jules silt loam, frequently flooded. This nearly level, deep, well drained soil is on flood plains. In the winter and spring, it is frequently flooded for long periods. Areas are mostly elongated and are parallel to streams. They are 10 to more than 75 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 15 inches thick. The underlying material to a depth of 60 inches is dark brown, friable silt loam stratified with thin layers of fine sandy loam. In some places more sand is in the soil profile. In other places the surface layer is darker. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Armiesburg and Stonelick soils in the higher positions on the landscape. Armiesburg soils have a darker surface soil than the Jules soil. Stonelick soils have more sand throughout than the Jules soil. Also included are areas of somewhat poorly drained soils in the lower positions on the landscape. Included soils make up about 10 to 15 percent of the unit.

The Jules soil has a high available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used as woodland. Some provide habitat for wildlife. A few areas are used for pasture.

Because of the flooding, this soil is generally unsuited to cultivated crops and to grasses and legumes for hay crops. It is poorly suited to pasture. The best suited pasture species are reed canarygrass and ladino clover. Levees help to control flooding. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding and frost action. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts remove excess water and help to prevent the damage caused by frost action. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is Vw. No woodland ordination symbol is assigned.

Js—Jules-Stonelick complex, frequently flooded. These nearly level, deep, well drained soils are on flood plains. In the winter and spring, they are frequently flooded for brief periods. The Jules soil is in the slightly lower areas, and the Stonelick soil is in the slightly higher areas. Areas are mostly elongated and are parallel to streams. They are 10 to more than 100 acres in size. They are about 60 percent Jules soil and 30 percent Stonelick soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Jules soil is dark brown silt loam about 9 inches thick. The upper part of the underlying material is brown and dark yellowish brown, friable silt loam. The lower part to a depth of 60 inches is dark yellowish brown, friable very fine sandy loam. Some places have more sand throughout. In some areas the surface layer is thicker and darker. In other areas the slope is more than 2 percent.

In a typical profile, the surface layer of the Stonelick soil is dark brown fine sandy loam about 9 inches thick. The upper part of the underlying material is dark yellowish brown, friable fine sandy loam and sandy loam. The lower part to a depth of 60 inches is yellowish brown, friable fine sandy loam. In some areas the surface layer is thicker and darker. In other areas

the soil has more clay in the surface layer and the underlying material. In some places the slope is more than 2 percent.

Included with these soils in mapping are small areas of the well drained Armiesburg soils in the higher positions on the landscape. These included soils have more clay throughout than the Jules and Stonelick soils and have a darker surface soil. Also included are areas of somewhat poorly drained soils. Included soils make up about 10 percent of the unit.

The Jules soil has a high available water capacity. The Stonelick soil has a moderate available water capacity. Permeability is moderate in the Jules soil and moderately rapid in the Stonelick soil. Organic matter content is moderately low in the surface layer of both soils. Runoff is slow.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

The Jules soil is well suited to corn and soybeans, and the Stonelick soil is fairly well suited. Flooding is a hazard on both soils, and droughtiness is a hazard on the Stonelick soil. Crusting on the Jules soil is a problem. Late planting or replanting is sometimes necessary because of the flooding. Small grain that is seeded in fall or early spring may be damaged by floodwater. Levees help to control flooding. Working the soils at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to spring-plow, spring-chisel, and no-till cropping systems.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding is a hazard unless it is controlled by levees. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, these soils are generally unsuitable as sites for dwellings and sanitary facilities. They are severely limited as sites for local roads because of the flooding on both soils and frost action on the Jules soil. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, installing culverts, and conveying runoff to suitable outlets reduce the wetness and the potential for frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned to the Jules soil. The woodland ordination symbol assigned to the Stonelick soil is 4A.

KcA—Kalamazoo loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on outwash plains. Areas are irregular in shape and are 20 to more than 200 acres in size.

In a typical profile, the surface layer is dark brown loam about 9 inches thick. The subsoil is about 41 inches thick. The upper part is brown, firm clay loam and sandy clay loam; the next part is brown, friable sandy loam; and the lower part is dark brown, very friable loamy coarse sand and gravelly loamy coarse sand. The underlying material to a depth of 60 inches is brown gravelly coarse sand. In some places sand and gravelly sand are at a depth of 20 inches. In other places silty material is in the upper part of the profile and is as much as 20 inches thick. In some areas the surface layer is darker. In other areas the soil has more clay in the lower part of the subsoil, the underlying material, or both. In some places the slope is more than 2 percent. In other places calcareous glacial till is within a depth of 60 inches. In some areas thin bands of sandy loam are in the lower part of the subsoil. Some areas are not a source of sand and gravel.

Included in mapping are small areas of the well drained Alvin soils in the higher positions on the landscape and the well drained Ockley soils in the lower positions. Alvin soils are less clayey in the upper part of the solum than the Kalamazoo soil, and Ockley soils have more clay in the solum. Included soils make up about 8 to 12 percent of the unit.

The Kalamazoo soil has a moderate available water capacity. Permeability is moderate in the upper part of the subsoil and very rapid in the lower part of the subsoil and in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture. A few are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Droughtiness is a hazard unless an irrigation system is used. Crusting is a problem. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Droughtiness is a hazard unless an irrigation system is used. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which grazing periods are shortened during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material help to prevent the structural damage caused by shrinking and swelling. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of the shrink-swell potential and low strength, this soil is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and improve the ability of the roads and streets to support vehicular traffic.

Because of poor filtering qualities, this soil is severely limited as a site for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity. Enlarging the absorption field or installing deep wells minimizes the adverse effects of the poor filtering capacity.

The land capability classification is IIs. The woodland ordination symbol is 4A.

KcB2—Kalamazoo loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on rises and side slopes on outwash plains. Areas are irregular in shape or elongated and are 5 to 40 acres in size.

In a typical profile, the surface layer is dark brown loam about 8 inches thick. It contains about 15 percent dark brown subsoil material. The subsoil is about 37 inches thick. The upper part is dark brown, firm clay loam and sandy clay loam; the next part is dark brown, friable sandy loam; and the lower part is dark brown, very friable loamy coarse sand and gravelly loamy coarse sand. The underlying material to a depth of 60 inches is brown gravelly coarse sand. In some areas the surface layer is gravelly, and in other areas it has more clay. In some places the upper part of the subsoil has less clay. In other places the upper part of the profile is silty material that is 20 inches thick. In some areas the soil has more clay in the lower part of the subsoil, the underlying material, or both. In other areas sand and gravelly sand are at a depth of 20 inches. In some places calcareous glacial till is within a depth of 60 inches. In other places the slope is less than 2 or more than 6 percent. In some areas thin bands of sandy loam are in the lower part of the subsoil. Some areas are not a source of sand and gravel.

Included with this soil in mapping are the well drained Alvin and Ockley soils in the lower areas. Alvin soils are less clayey in the upper part of the solum than the Kalamazoo soil, and Ockley soils have more clay in the solum. Included soils make up about 5 to 15 percent of the unit.

The Kalamazoo soil has a moderate available water capacity. Permeability is moderate in the upper part of the subsoil and very rapid in the lower part of the subsoil and in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops.

A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Droughtiness, erosion, and runoff are hazards. Crusting is a problem. An irrigation system helps to overcome droughtiness. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Erosion, droughtiness, and runoff are hazards. A permanent cover of grasses and legumes helps to control erosion. An irrigation system helps to control droughtiness. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with a coarser textured material help to prevent the structural damage caused by shrinking and swelling. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of the shrink-swell potential and low strength, this soil is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and improve the ability of the roads and streets to support vehicular traffic.

Because of poor filtering qualities, this soil is severely limited as a site for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity. Enlarging the absorption field or installing deep wells minimizes the adverse effects of the poor filtering capacity.

The land capability classification is IIe. The woodland ordination symbol is 4A.

KfA—Kendall silt loam, 0 to 1 percent slopes. This nearly level, deep, somewhat poorly drained soil is on slight rises on outwash plains. Areas are irregular in shape and are 3 to more than 50 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is about 50 inches thick. The upper part is grayish brown, mottled, firm silt loam and silty clay loam; the next part is brown, mottled, firm silty clay loam and silt loam; and the lower part is yellowish brown, mottled, friable silt loam. The underlying material to a depth of 70 inches is yellowish brown very fine sandy loam and fine sandy loam. In some areas the deposit of silty material is thinner. In other areas the underlying material has less clay. In some places the subsoil has less clay. In other places calcareous glacial till is within a depth of 60 inches. In some areas the slope is more than 1 percent. In other areas the subsoil has less silt and more sand. In places this soil is in slight depressions.

Included with this soil in mapping are areas of the moderately well drained Rockfield soils and the well drained Camden soils on slight rises and knolls and the poorly drained Patton soils in narrow depressions. Included soils make up about 8 to 15 percent of the unit.

The Kendall soil has a high available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is slow. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-chisel and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. It is better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. The wetness is a limitation, and frost heaving is a hazard. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, this soil is severely limited as a site for dwellings. A drainage system can help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing perimeter drains around the absorption field helps to lower the water table.

The land capability classification is IIw. The woodland ordination symbol is 4A.

KgA—Kendall-Fincastle silt loams, 0 to 1 percent slopes. These nearly level, deep, somewhat poorly drained soils are on slight rises on till plains. The Kendall soil is in the lower areas, and the Fincastle soil is in the higher areas. Areas are irregular in shape and are 5 to more than 100 acres in size. They are about 65 percent Kendall soil and about 25 percent Fincastle soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Kendall soil is dark grayish brown silt loam about 10 inches thick. The subsoil is about 39 inches thick. The upper part is brown, mottled, firm silty clay loam, and the lower part is dark yellowish brown and yellowish brown, mottled, friable silt loam. The underlying material to a depth of 60 inches is brown, mottled loam stratified with thin layers of silt loam and fine sandy loam. In some areas the soil has less clay in the subsoil, the underlying material, or both. In other areas the subsoil has less silt and more sand. In some places the slope is more than 1 percent. In other places the silty material is more than 60 or less than 40 inches thick.

In a typical profile, the surface layer of the Fincastle soil is dark grayish brown silt loam about 9 inches thick. The subsoil is about 33 inches thick. The upper part is brown and grayish brown, mottled, firm silty clay loam, and the lower part is dark grayish brown, mottled, firm clay loam. The underlying material to a depth of 60 inches is brown and yellowish brown loam. In some places the subsoil has less clay, and in other places it has less silt and more sand. In some areas the slope is more than 1 percent.

Included with these soils in mapping are areas of the moderately well drained Rockfield soils on slight rises and knolls and the poorly drained Cyclone soils in narrow depressions. Also included are a few areas where glacial till is within 40 inches of the surface. Included soils make up about 10 percent of the unit.

The Kendall and the Fincastle soils have a high available water capacity. Permeability is moderate in the Kendall soil. It is moderate in the subsoil of the Fincastle soil and moderately slow in the underlying

material. Organic matter content is moderately low in the surface layer of both soils. Runoff is slow. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, these soils are well suited to corn, soybeans, and small grain. Wetness is the main limitation. Crusting is a problem. Subsurface drains can remove excess water. Open ditches are needed in some places for subsurface drain outlets. A system of conservation tillage that leaves protective amounts of crop residue on the surface helps to control erosion, prevent crusting, improve tilth, increase the organic matter content, and promote the infiltration of water. The soils are well suited to fall-chisel and ridge-till cropping systems.

If drained, these soils are well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. They are better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. The wetness is a limitation, and frost heaving is a hazard. Excess water can be removed by surface drains, subsurface drains, or both. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which grazing periods are shortened during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, these soils are severely limited as sites for dwellings. Subsurface drains can help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of low strength and frost action, these soils are severely limited as sites for local roads and streets. Strengthening the base material or replacing it with a more suitable material improves the ability of the roads and streets to support vehicular traffic. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action.

Because of the wetness and the moderately slow permeability, these soils are severely limited as sites for septic tank absorption fields. Installing perimeter drains around the absorption field helps to lower the water table. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Ld—Landes fine sandy loam, rarely flooded. This nearly level, deep, well drained soil is on flood plains. During the winter and spring, it is subject to rare flooding of brief duration. Areas are irregular in shape and are 10 to more than 60 acres in size.

In a typical profile, the surface layer is very dark grayish brown fine sandy loam about 17 inches thick. The subsoil is 23 inches thick. It is dark brown and dark yellowish brown, friable fine sandy loam in the upper part and brown, very friable loamy fine sand stratified with fine sandy loam in the lower part. In some places the surface soil and subsoil have less sand and more silt. In other places the dark surface layer is more than 24 inches thick. In some areas the surface is gravelly. In other areas the surface layer is lighter in color. In a few places the soil has less clay in the surface layer, the subsoil, or both. In other places very gravelly coarse sand is within a depth of 80 inches. In some areas the slope is more than 2 percent. Some areas are occasionally flooded.

Included with this soil in mapping are small areas of the very poorly drained Cohoctah soils, the somewhat poorly drained Ceresco and Ceresco Variant soils, and the moderately well drained Landes soils in the lower positions on the landscape. Included soils make up about 10 to 15 percent of the unit.

The Landes soil has a moderate available water capacity. Permeability is moderately rapid in the subsoil and rapid in the underlying material. Organic matter content is moderate in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Droughtiness is a hazard. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green

manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to spring-plow, spring-chisel, and no-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Frost heaving and droughtiness are hazards. An irrigation system helps to control droughtiness. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Seedlings can survive and grow well, however, if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of frost action and the flooding. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and reduce the wetness. Conveying runoff to suitable outlets also reduces the wetness and the potential for frost action.

The land capability classification is IIs. The woodland ordination symbol is 7A.

Lo—Landes loam, moderately wet, occasionally flooded. This nearly level, deep, moderately well drained soil is on flood plains. During the winter and early spring, it is subject to occasional flooding of brief duration. Areas are elongated and are 10 to more than 30 acres in size.

In a typical profile, the surface soil is very dark grayish brown loam about 14 inches thick. The subsoil is about 22 inches thick. It is brown, friable very fine sandy loam and fine sandy loam in the upper part; brown, friable sandy loam in the next part; and brown, mottled, friable sandy loam in the lower part. The underlying material to a depth of 60 inches is brown and olive brown, mottled sandy loam stratified with thin layers of loamy sand. In some areas the surface layer is lighter in color, and in other areas it is less than 10 inches thick. In a few areas less sand and more silt are throughout the profile. In some places the surface layer is gravelly, and in other places it has less clay. In some areas the soil has more clay in the subsoil, the underlying material, or both. In other areas calcareous glacial till is within a depth of 60 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are areas of the somewhat poorly drained Ceresco soils on the lower rises, the very poorly drained Cohoctah soils in depressions, and the well drained Landes and somewhat excessively drained Moundhaven soils in the higher areas. Some areas are frequently flooded for long periods. Included soils make up about 8 to 15 percent of the unit.

The Landes soil has a moderate available water capacity. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. Organic matter content is moderate in the surface layer. Runoff is slow. The water table is at a depth of 4 to 6 feet during the winter and early spring.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn and soybeans. Flooding is a hazard. Crusting is a problem. Late planting or replanting is sometimes necessary because of the flooding. Small grain that is seeded in fall or early spring may be damaged by floodwater. Levees help to control flooding. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to spring-plow, spring-chisel, and no-till cropping systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding is a hazard unless it is controlled by levees. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and

hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Seedlings can survive and grow well, however, if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities and is severely limited as a site for local roads. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by flooding. Conveying runoff to suitable outlets reduces the wetness.

The land capability classification is IIw. The woodland ordination symbol is 10A.

Ls—Landes-Moundhaven complex, occasionally flooded. These nearly level, deep soils are on flood plains. The Landes soil is in the slightly lower areas and is well drained, and the Moundhaven soil is in the slightly higher areas and is somewhat excessively drained. During the winter and early spring, these soils are subject to occasional flooding of brief duration. Areas are elongated and are 10 to more than 40 acres in size. They are about 55 percent Landes soil and 35 percent Moundhaven soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Landes soil is very dark grayish brown fine sandy loam about 15 inches thick. The subsoil is about 24 inches thick. It is friable. The upper part is dark brown fine sandy loam, and the lower part is brown and dark yellowish brown sandy loam. The underlying material to a depth of 60 inches is brown loamy sand. In some areas the surface layer is lighter in color or is less than 10 inches thick. In a few areas the soil has less sand and more silt throughout. In other areas the surface layer is gravelly. In some places the surface layer has less clay or more clay. In other places the subsoil has less clay. In a few areas the soil has carbonates in the upper part. In other areas it has more clay in the subsoil, the underlying material, or both. In some places the underlying material is calcareous gravelly sand. In other places the slope is more than 2 percent.

In a typical profile, the surface layer of the Moundhaven soil is brown loamy fine sand about 9 inches thick. The subsoil is about 45 inches thick. It is brown and dark yellowish brown, friable loamy sand. The underlying material to a depth of 60 inches is brown sand. In a few areas the soil has carbonates in the upper part. In other areas it has more clay in the subsoil, the underlying material, or both. In some places the underlying material is calcareous gravelly sand. In other places the surface layer is gravelly or is dark. In some areas the slope is more than 2 percent.

Included with these soils in mapping are areas of the somewhat poorly drained Ceresco soils on the lower rises and the very poorly drained Cohoctah soils in depressions. Also included are areas that are frequently flooded. Included soils make up about 10 percent of the unit.

The Landes soil has a moderate available water capacity. The Moundhaven soil has a low available water capacity. Permeability is moderately rapid in the subsoil of the Landes soil and rapid in the underlying material. It is rapid in the Moundhaven soil. Organic matter content is moderate in the surface layer of the Landes soil and moderately low in the Moundhaven soil. Runoff is slow.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are well suited to corn and soybeans. Flooding is a hazard on both soils, and droughtiness is a hazard on the Moundhaven soil. Late planting or replanting is sometimes necessary because of the flooding. Small grain that is seeded in fall or early spring may be damaged by floodwater. Levees help to control flooding. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface (fig. 8), cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to spring-plow, spring-chisel, and no-till cropping systems.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding and droughtiness are hazards unless levees and an irrigation system are used. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

Figure 8.—Disked corn stubble left on Landes-Moundhaven complex, occasionally flooded, helps to keep the cropland in good condition. The woodland in the background is in an area of Hennepin loam, 30 to 70 percent slopes.

These soils are well suited to trees. Plant competition is severe on the Landes soil. Seedling mortality, the windthrow hazard, and plant competition are the main management concerns on the Moundhaven soil. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, these soils are generally unsuitable as sites for dwellings and sanitary facilities and are severely limited as sites for local roads. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by flooding. Levees help to control flooding. Conveying runoff to suitable outlets reduces the wetness.

The land capability classification is IIw. The woodland ordination symbol assigned to the Landes soil is 7A, and the one assigned to the Moundhaven soil is 4S.

Ma—Mahalasville silty clay loam, gravelly substratum. This nearly level, deep, very poorly drained soil is in broad depressions on terraces. It is frequently ponded by runoff from the higher adjacent areas. Areas are mostly irregular in shape, but many are elongated. They are 3 to more than 100 acres in size.

In a typical profile, the surface layer is very dark grayish brown, firm silty clay loam about 12 inches thick. The subsoil is about 38 inches thick. The upper part is dark gray and gray, mottled, firm silty clay loam; the next part is dark gray, mottled, friable silt loam; and the lower part is olive gray, mottled, friable loam. The underlying material to a depth of 60 inches is grayish brown very gravelly loamy coarse sand and very gravelly coarse sand. In some areas the dark surface layer is less than 10 inches thick. In other areas the surface layer is lighter colored depositional material or is mucky silty clay loam or mucky silt loam. In places, the loamy outwash is thicker and the loose sand and gravel are at a depth of more than 80 inches. Some areas are not a source of sand and gravel. In some areas the silty material is as much as 60 inches thick. In a few places the subsoil has more sand and less silt or less clay. In other places the lower part of the subsoil has thin layers of loamy sand or sand. In some areas calcareous glacial till is within a depth of 60 inches. In other areas the surface layer and the subsoil have more sand and fine gravel. In a few places marl is in the underlying material.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and Waynetown soils. Included soils make up about 10 to 15 percent of the unit.

The Mahalasville soil has a high available water capacity. Permeability is moderate in the subsoil and rapid in the underlying material. Organic matter content is high in the surface layer. Runoff is ponded or very slow. The water table is 0.5 foot above to 1.0 foot below the surface during the winter and early spring. The surface layer becomes cloddy and hard to work if it is tilled when too wet.

Most areas of this soil are drained and used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Open ditches are needed in some places for subsurface drain outlets. The very fine sand can flow into the subsurface drains and plug them. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Water-tolerant species grow best. The wetness is a limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Maintaining a crown in roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. Using coarse textured subgrade or base material helps to prevent the damage caused by frost action and

improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Mb—Mahalasville silty clay loam, till substratum. This nearly level, deep, very poorly drained soil is in broad, depressional areas on outwash plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are elongated or irregular in shape, or they are fingerlike delineations extending between better drained soils on slight rises. They are 5 to more than 150 acres in size.

In a typical profile, the surface layer is black silty clay loam about 11 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown and grayish brown, mottled, firm silty clay loam, and the lower part is grayish brown and dark grayish brown, mottled, firm clay loam. The upper part of the underlying material is grayish brown very gravelly loamy sand. The lower part to a depth of 60 inches is brown loam. In places the dark surface layer is less than 10 inches thick. In some areas the surface layer is lighter colored depositional material or is muck or mucky silty clay loam. In other areas it has less clay. In some places the deposit of silty material is thinner or thicker. In other places the lower part of the subsoil has thin layers of loamy sand, sand, or both. In some areas the underlying material is glacial outwash. In other areas calcareous, firm glacial till is within a depth of 40 inches. In some places the subsoil has more sand and less clay or less silt. In other places the surface layer and the subsoil have more sand and fine gravel. In some areas the slope is more than 2 percent. In a few places marl is in the lower part of the solum.

Included with this soil in mapping are areas of the somewhat poorly drained Waynetown and Sleeth soils in the slightly higher areas. They make up about 8 to 15 percent of the unit.

The Mahalasville soil has a high available water capacity. Permeability is moderate in the subsoil and moderately slow in the underlying glacial till. Organic matter content is high in the surface layer. Runoff is very slow or ponded. The water table is 0.5 foot above to 1.0 foot below the surface during the winter and early spring. The surface layer becomes cloddy and hard to work if it is tilled when too wet.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or both. Open ditches are needed in some places for subsurface drain outlets. The very fine sand can flow into the drains and plug them. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed

trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Maintaining a crown on roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. Using coarse textured subgrade or base material helps to prevent the damage caused by frost action and improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Mc—Mahalasville-Treaty silt loams. These nearly level, deep, very poorly drained soils are in depressional areas on till plains and moraines. They are frequently ponded by surface runoff from the higher adjacent areas. Areas are elongated or irregular in shape, or they are fingerlike delineations extending between better drained soils on slight rises. They are 5 to 20 acres in size. The areas are about 50 percent Mahalasville soil and 50 percent Treaty soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Mahalasville soil is very dark grayish brown silt loam about 11 inches thick. The subsoil is about 42 inches thick. The upper part is very dark gray and dark grayish brown, mottled, firm silty clay loam; the next part is grayish brown, mottled, firm silty clay loam and clay loam; and the lower part is grayish brown, mottled, firm sandy loam and friable sandy loam stratified with loamy sand. The underlying material to a depth of 60 inches is grayish brown, mottled silt loam stratified with thin layers of fine sandy loam and loamy sand. In some areas the dark surface layer is less than 10 inches thick, and in other areas the surface layer is lighter colored depositional material. In some places the surface layer is muck or mucky silt loam or has more clay. In other places the slope is more than 2 percent. In some areas the deposit of silty material is thinner or thicker. In other areas the subsoil has less clay. In some places the surface layer and the subsoil have more sand and fine gravel. In other places the upper part of the subsoil has more sand and less silt. In a few places marl is in the underlying material.

In a typical profile, the surface layer of the Treaty soil is very dark grayish brown silt loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is very dark gray and dark grayish brown, mottled, firm silty clay loam; the next part is dark grayish brown, mottled, firm clay loam; and the lower part is brown, mottled, firm loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some areas the dark surface layer is less than 10 inches thick, and in other areas the surface layer is lighter colored depositional material. In some places the surface layer is muck or mucky silt loam, and in other places it contains more clay. In some areas the deposit of silty material is thinner or thicker. In other areas calcareous, firm glacial till is within a depth of 40 inches. In some places the slope is more than 2 percent. In other places the subsoil has less clay. In some areas the surface layer and the subsoil have more sand and fine gravel. In other areas the upper part of the subsoil has more sand and less silt.

Included with these soils in mapping are areas of the somewhat poorly drained Crosier and Whitaker soils in the slightly higher areas. They make up about 8 to 15 percent of the unit.

The Mahalasville and Treaty soils have a high available water capacity. Permeability is moderate in the Mahalasville soil. It is moderate in the subsoil of the Treaty soil and moderately slow in the underlying glacial till. Organic matter content is high in the surface layer of both soils. Runoff is very slow or ponded. The water table is 0.5 foot above to 1.0 foot below the surface during the winter and early spring.

Most areas of these soils are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, these soils are well suited to corn, soybeans, and small grain. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or both. Open ditches are needed in some places for subsurface drain outlets. The very fine sand can flow into the drains and plug them. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, these soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during

wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, these soils are generally unsuitable as sites for dwellings and sanitary facilities. They are severely limited as sites for local roads because of the ponding, low strength, and frost action. Maintaining a crown on roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce ponding. Using coarse textured subgrade or base material helps to prevent the damage caused by low strength and by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

MdB2—Martinsville, till substratum-Miami loams, 2 to 6 percent slopes, eroded. These gently sloping, deep, well drained soils are on rises and side slopes on rolling till plains. The Miami soil is in the more sloping areas. Areas are irregular in shape and are 5 to more than 20 acres in size. They are about 55 percent Martinsville soil that has a till substratum and 30 percent Miami soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Martinsville soil is brown loam about 8 inches thick. It contains about 20 percent dark yellowish brown subsoil material. The subsoil is about 57 inches thick. The upper part is dark yellowish brown and dark brown, firm clay loam; the next part is dark brown, friable sandy loam; and the lower part is dark brown, friable sandy clay loam. The underlying material to a depth of 80 inches is brown loam. In some places the surface layer has more clay. In a few places the surface layer and the upper part of the subsoil are silty. In some areas the glacial till is within a depth of 60 inches. In a few areas a thin layer of calcareous gravelly coarse sand, gravelly loamy sand, or loamy sand is directly above the underlying glacial till. In some places the lower part of the subsoil is mottled. In other places the slope is less than 2 or more than 6 percent.

In a typical profile, the surface layer of the Miami soil is brown loam about 8 inches thick. It contains about 20 percent dark yellowish brown subsoil material. The subsoil is dark yellowish brown, firm clay loam about 27 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the lower part of the subsoil is mottled. In other places the surface layer has more clay. In some areas the subsoil has less clay. In other areas it is loamy glacial outwash underlain by glacial till. In some places the slope is less than 2 or more than 6 percent.

Included with these soils in mapping are areas of the somewhat poorly drained Crosby and Fincastle soils in the lower areas and the poorly drained Washtenaw soils in narrow depressional areas. Included soils make up about 15 percent of the unit.

The Martinsville soil has a high available water capacity. The Miami soil has a moderate available water capacity. Permeability is moderate in the Martinsville soil. It is moderate in the subsoil of the Miami soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves

protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to no-till and ridge-till cropping systems.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, these soils are moderately limited as sites for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Wetness may be a problem if the lower part of a basement is constructed in firm glacial till. A subsurface drainage system of perimeter interceptor drains can reduce the wetness. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of low strength, these soils are severely limited as sites for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic.

Because of the moderate permeability, the Martinsville soil is moderately limited as a site for septic tank absorption fields. The Miami soil is severely limited because of the moderately slow permeability. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 5A.

MfC3—Martinsville, till substratum-Miami clay loams, 6 to 12 percent slopes, severely eroded. These moderately sloping, deep, well drained soils are on side slopes on till plains. The Miami soil is in the more sloping areas. Areas are irregular in shape and are 3 to 20 acres in size. They are about 55 percent Martinsville soil that has a till substratum and 30 percent Miami soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Martinsville soil is brown clay loam about 7 inches thick. The subsoil is about 54 inches thick. The upper part is dark yellowish brown and dark brown, firm clay loam; the next part is dark yellowish brown, firm sandy clay loam; and the lower part is dark brown, friable sandy loam. The underlying material to a depth of 70 inches is yellowish brown loam. In a few places the glacial till is within a depth of 60 inches. In some areas a thin layer of calcareous gravelly coarse sand, gravelly loamy sand, or loamy sand is directly above the underlying glacial till. In other areas the slope is less than 6 or more than 12 percent.

In a typical profile, the surface layer of the Miami soil is brown clay loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, firm clay loam, and the lower part is brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the subsoil is loamy glacial outwash directly above the underlying glacial till. In other places the soil has less clay in the subsoil, the surface layer, or both. In some areas the calcareous glacial till is within a depth of 24 inches. In other areas the slope is less than 6 or more than 12 percent.

Included with these soils in mapping are the somewhat poorly drained Crosby and Fincastle soils on foot slopes and in drainageways. Also included are the

Figure 9.—Yields of corn on Martinsville, till substratum-Miami clay loams, 6 to 12 percent slopes, severely eroded, are poor because of the eroded condition of these soils.

very poorly drained Washtenaw soils in depressions and drainageways. Included soils make up about 15 percent of the unit.

The Martinsville soil has a high available water capacity. The Miami soil has a moderate available water capacity. Permeability is moderate in the Martinsville soil. It is moderate in the subsoil of the Miami soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium.

Most areas of these soils are used for cultivated crops. Some are used for hay, pasture, or woodland

These soils are poorly suited to corn, soybeans, and small grain. Erosion and runoff are hazards (fig. 9). Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to no-till and ridge-till cropping systems.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for pasture. They are fairly well suited to hay. Erosion and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant

density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential and the slope, these soils are moderately limited as sites for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Wetness may be a problem if the lower part of a basement is constructed in firm glacial till. A subsurface drainage system of perimeter interceptor drains can reduce the wetness. The buildings should be constructed in the less sloping areas or designed so that they conform to the natural slope of the land. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of low strength, these soils are severely limited as sites for local roads and streets. Frost action also is a limitation. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the moderate permeability and the slope, the Martinsville soil is moderately limited as a site for septic tank absorption fields. The Miami soil is severely limited because of the moderately slow permeability. In most areas of the Miami soil, lateral seepage at the top of the glacial till can result in the surfacing of effluent. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the restricted permeability. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 5A.

MhD3—Miami clay loam, 15 to 20 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on side slopes on till plains and moraines. Areas are elongated or irregular in shape and are 4 to 15 acres in size.

In a typical profile, the surface layer is brown clay loam about 6 inches thick. The subsoil is dark yellowish brown, firm clay loam about 20 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the soil has less clay in the subsoil, the underlying material, or both. In other places, glacial till is at a greater depth and the underlying material is glacial outwash. In some areas calcareous glacial till is at a depth of 14 inches. In other areas the slope is less than 15 or more than 20 percent.

Included with this soil in mapping are areas of the well drained Martinsville soils on ridges and knolls. These soils are deeper to calcareous glacial till than the Miami soil. They make up about 5 to 10 percent of the unit.

The Miami soil has a moderate available water capacity. Permeability is moderate in the subsoil and moderately slow in the underlying material. Organic matter content is low in the surface layer. Runoff is rapid.

Most areas of this soil are used for pasture. A few are used for hay, woodland, or cultivated crops.

This soil is generally unsuited to corn, soybeans, and small grain because of the severe erosion and the continuing erosion hazard. Some areas have small gullies that are difficult to cross with farm machinery.

This soil is fairly well suited to grasses and legumes, such as orchardgrass and alfalfa, for pasture. It is poorly suited to hay crops. Erosion and runoff are hazards. Operating some types of equipment on the steeper slopes can be hazardous. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A system of conservation tillage that leaves protective amounts of crop residue on the surface helps to control runoff and erosion until the grasses and legumes are established. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which the grazing periods are shortened during the summer help to control erosion, minimize surface compaction, maintain good plant density and

hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the slope, this soil is severely limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of the low strength and the slope, this soil is severely limited as a site for local roads and streets. Strengthening or replacing the base material improves the ability of the roads and streets to support vehicular traffic. Cuts and fills can reduce the slope. Constructing the roads and streets on the contour helps to overcome the slope.

Because of the moderately slow permeability and the slope, this soil is severely limited as a site for septic tank absorption fields. In most areas lateral seepage at the top of the glacial till can result in the surfacing of effluent. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is VIe. The woodland ordination symbol is 5A.

MkB2—Miami-Crosier complex, 2 to 6 percent slopes, eroded. These gently sloping, deep soils are on rises on undulating till plains and on side slopes adjacent to drainageways. The Miami soil is on the more sloping knolls and narrow ridgetops and is well drained. The Crosier soil is on the broader ridgetops, on foot slopes, and in swales. It is somewhat poorly drained. Areas are irregular in shape and are 3 to more than 40 acres in size. They are about 50 percent Miami soil and 40 percent Crosier soil. The two soils occur as areas so intricately mixed or small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Miami soil is brown loam about 7 inches thick. It contains about 20 percent dark yellowish brown subsoil material. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, firm clay loam and loam, and the lower part is brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In a few places the calcareous glacial till is at a depth of less than 24 inches. In other places the lower part of the subsoil is sandy or loamy glacial outwash. In some severely eroded areas, the surface layer has more clay. In other areas the subsoil is mottled within a depth of 40 inches. In places the slope is less than 2 or more than 6 percent.

In a typical profile, the surface layer of the Crosier soil is dark brown silt loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay loam; the next part is dark yellowish brown and yellowish brown, mottled, firm clay loam; and the lower part is brown, mottled, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the silty material is thicker. In a few places the lower part of the subsoil is sandy or loamy glacial outwash. In other places the slope is less than 2 percent.

Included with these soils in mapping are areas of the somewhat poorly drained Whitaker soils in the slightly lower areas on till plains, some well drained soils on very steep slopes, and the Riddles soils on the less sloping knolls and ridges. Riddles and Whitaker soils are deeper to calcareous glacial till than the Miami and Crosier soils. Included soils make up about 10 percent of the unit.

The Miami and the Crosier soils have a moderate available water capacity. Permeability is moderate in the subsoil of the Miami soil and moderately slow in the underlying material. It is moderately slow in the Crosier soil. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium. In the Crosier soil the water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are well suited to corn, soybeans, and small grain. Wetness is a limitation in areas of the Crosier soil. Erosion and runoff are hazards. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Working the soil at the correct moisture content minimizes compaction and

helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. Both soils are well suited to a ridge-till cropping system, and the Miami soil is well suited to a no-till system.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion, runoff, and frost heaving are hazards. The wetness is a limitation in areas of the Crosier soil. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition. A drainage system increases forage yields on the Crosier soil.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, the Miami soil is moderately limited as a site for dwellings. The Crosier soil is severely limited because of the wetness. Erosion is a hazard. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. A drainage system helps to lower the water table. The buildings should be constructed on raised, well compacted fill material. In areas of the Crosier soil, the dwellings should be constructed without basements. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of low strength, these soils are severely limited as sites for local roads and streets. In addition, the Crosier soil is severely limited because of frost action. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the moderately slow permeability, these soils are severely limited as sites for septic tank absorption fields. In addition, the Crosier soil is severely limited because of the wetness. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability. A subsurface drainage system of perimeter interceptor drains can reduce the wetness.

The land capability classification is IIe. The woodland ordination symbol assigned to the Miami soil is 5A, and the one assigned to the Crosier soil is 4A.

Mm—Milford silty clay loam. This nearly level, deep, very poorly drained soil is in broad, troughlike areas on till plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape or circular and are 10 to more than 50 acres in size.

In a typical profile, the surface soil is black silty clay loam about 14 inches thick. The subsoil is about 56 inches thick. In sequence downward, it is very dark gray, mottled, firm silty clay loam; dark grayish brown, mottled, firm silty clay and silty clay loam; grayish brown and dark grayish brown, mottled, firm silty clay loam; and dark grayish brown, mottled, firm silty clay loam stratified with silt loam. The underlying material to a depth of 80 inches is grayish brown, mottled silty clay loam stratified with silt loam. In some areas the dark surface layer is less than 12 inches thick. In other areas the surface layer is lighter colored depositional material. In some places the surface layer has less clay or is mucky silty clay loam, mucky silt loam, or muck. In other places the soil has less clay or more sand in the subsoil, the underlying material, or both. In some areas calcareous glacial till is within a depth of 60 inches. Some areas are underlain by loamy sand and sandy loam within a depth of 80 inches.

Included with this soil in mapping are areas of the very poorly drained Houghton, Palms, and Wallkill soils in the lower positions on the landscape. These soils have muck layers. Included soils make up about 5 to 10 percent of the unit.

The Milford soil has a high available water capacity. Permeability is moderately slow. Organic matter content is high in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface from

late fall through early spring. The surface layer becomes cloddy and hard to work if it is tilled when too wet.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn and soybeans. Wetness is a limitation. Crusting is a problem. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. If drained, the soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. This soil is well suited to fall-plow and fall-chisel cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Frost heaving is a hazard. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action, reduce the wetness, and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IIw. A woodland ordination symbol is not assigned.

Mo—Milford silt loam, pothole. This nearly level, deep, very poorly drained soil is in potholes on till plains, terraces, and outwash plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape or circular and are 1 to 20 acres in size.

In a typical profile, the surface soil is very dark grayish brown silt loam about 15 inches thick. The subsurface layer is very dark gray, mottled silty clay loam about 7 inches thick. The subsoil is about 46 inches thick. The upper part is dark grayish brown, mottled, firm clay loam, and the lower part is grayish brown, mottled, firm silty clay loam. The underlying material to a depth of 80 inches is grayish brown, mottled loam. In some areas the dark surface layer is less than 10 inches thick. In other areas the surface layer is lighter colored depositional material. In some places the surface layer has more clay or is silt loam or muck. In other places the soil has less clay or more sand in the subsoil, the underlying material, or both. In some areas calcareous glacial till is within a depth of 60 inches. Other areas are underlain by loamy sand and sandy loam within a depth of 80 inches.

Included with this soil in mapping are the very poorly drained Wallkill soils in the lower areas. These soils have muck under the surface layer. They make up about 5 to 15 percent of the unit.

The Milford soil has a high available water capacity. Permeability is moderately slow. Organic matter content is high in the surface layer. Runoff is ponded or very slow. The water table is at or above the surface from late fall through early spring.

Most areas of this soil are drained and used for cultivated crops. A few are used for hay, pasture, woodland, or habitat for wildlife.

If drained, this soil is fairly well suited to corn and soybeans. Ponding is a hazard, and wetness is a limitation. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established. Late planting or replanting is sometimes necessary because of the ponding. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. The ponding hinders the use of equipment. Machinery bogs down in ponded areas. Surface inlets are needed in most areas to move excess water to the subsurface drains. In some areas no drainage outlet is available for subsurface drains. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these.

Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves

protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow and fall-chisel cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The ponding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action, reduce the wetness, and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IVw. No woodland ordination symbol is assigned.

Mp—Milford silty clay loam, occasionally flooded. This nearly level, deep, very poorly drained soil is on a broad lake plain. From late fall through early spring, it is subject to occasional flooding of brief duration. Areas are irregular in shape and are 5 to more than 20 acres in size.

In a typical profile, the surface soil is black silty clay loam about 14 inches thick. The subsoil is about 56 inches thick. The upper part is very dark gray, mottled, firm silty clay loam; the next part is dark grayish brown, mottled, firm silty clay loam; and the lower part is grayish brown and dark grayish brown, mottled, firm silty clay loam. The underlying material to a depth of 80 inches is grayish brown, mottled silty clay loam stratified with silt loam. In places the dark surface layer is less than 10 inches thick. In some areas the surface layer is lighter colored depositional material. In other areas it has less clay or is mucky silty clay loam, mucky silt loam, or muck. In some places the soil has less clay or more sand in the subsoil, the underlying material, or both. In other places calcareous glacial till is within a depth of 60 inches. Some areas are underlain by loamy sand and sandy loam within a depth of 80 inches.

Included with this soil in mapping are areas of soils that are frequently flooded and undrained areas that remain wet most of the year. Included soils make up about 5 to 10 percent of the unit.

The Milford soil has a high available water capacity. Permeability is moderately slow. Organic matter content is high in the surface layer. Runoff is slow. The water table is at or near the surface from late fall through early spring. The surface layer becomes cloddy and hard to work if it is tilled when too wet.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn and soybeans. Flooding is a hazard, and wetness is a limitation. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by floodwater during the winter and early spring even if a drainage system has been established for row crops. Late planting or replanting is sometimes necessary because of the flooding. A cold soil temperature is a limitation. The wetness hinders normal root growth, resulting in a shallow root zone. Levees help to control flooding. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains.

If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod,

and reduces plant density and hardiness. Flooding can be controlled by levees. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, the wetness, and low strength. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts reduce the wetness and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets also reduces the wetness.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Mt—Millsdale loam. This nearly level, moderately deep, very poorly drained soil is in depressions on bedrock terraces. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape or circular and are 5 to more than 30 acres in size.

In a typical profile, the surface soil is very dark grayish brown loam about 18 inches thick. The subsoil is about 17 inches thick. The upper part is dark gray, mottled, firm clay loam, and the lower part is dark grayish brown, mottled, firm gravelly clay loam. The underlying material is hard limestone bedrock. In places, sand and gravel layers are above the limestone and the depth to limestone bedrock is more than 40 inches. In some areas the dark surface layer is less than 10 inches thick. In other areas the surface layer is lighter colored depositional material or is a thin layer of mucky loam or muck. In some places it has more clay. In a few places the subsoil has more silt and less sand or more sand and less clay. In other places the lower part of the subsoil has thin layers of loamy sand or sand. In some areas the slope is more than 2 percent. In other areas the surface layer and the upper part of the subsoil have more gravel. In places the lower part of the solum is gravelly sandy clay, gravelly loam, or gravelly sandy loam.

Included with this soil in mapping are small areas of the very poorly drained Palms Variant soils in the slightly lower areas. These soils have more muck than the Millsdale soil. Also included are areas of the well drained Milton Variant and Mudlavia Variant soils in the higher areas and areas of saturated soils on which the dominant vegetation is wetland weeds. Included soils make up about 10 to 15 percent of the unit.

The Millsdale soil has a low available water capacity. Permeability is moderately slow. Organic matter content is high in the surface layer. Runoff is ponded or very slow. The water table is at or above the surface from late fall through spring.

Most areas of this soil are drained and are used for cultivated crops. Some are used for pasture, woodland, or habitat for wetland wildlife.

If drained, this soil is fairly well suited to corn and soybeans. Wetness and the depth to bedrock are limitations, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established. The wetness and the ponding can hinder the use of farm equipment. Excess water can be removed by surface drains, subsurface drains, or both. The depth to bedrock interferes with the installation of subsurface drains. Open ditches are needed in some places, but measures to overcome the depth to bedrock may not be economically feasible. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the

summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of low strength, the ponding, and the shrink-swell potential. Strengthening or replacing the base material with a better suited material improves the ability of the roads to support vehicular traffic. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by ponding and by shrinking and swelling.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

MuB—Milton Variant channery silt loam, 1 to 4 percent slopes, flaggy. This gently sloping, shallow, well drained soil is on bedrock terraces. Areas are irregular in shape and are 5 to more than 40 acres in size.

In a typical profile, the surface layer is brown channery silt loam about 4 inches thick. The subsoil is brown, firm very channery silt loam about 8 inches thick. The underlying material is hard limestone bedrock. In some areas the surface is cobbly or very cobbly. In other areas the subsoil has less clay or contains gray mottles. In some places the slope is less than 1 or more than 4 percent. In other places the surface layer is darker. In some areas bedrock is exposed on the surface. In other areas the depth to bedrock is more than 20 inches. In places the solum is loam or silt loam.

Included with this soil in mapping are the well drained Mudlavia Variant soils in the nearly level areas. These soils are deeper to bedrock than the Milton Variant soil. Also included are small areas of the very poorly drained Millsdale soils in the lower positions on the landscape. Included soils make up about 8 to 15 percent of the unit.

The Milton Variant soil has a very low available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for pasture or cultivated crops. Some are used for hay or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness is a hazard. The rock fragments and the depth to bedrock are limitations. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Droughtiness is a hazard unless an irrigation system is used. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is fairly well suited to trees. The shallow rooting depth is a limitation. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in

the stand may be desirable because the trees provide shade and protection for seedlings. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shallow depth to bedrock, this soil is generally unsuitable as a site for dwellings, local roads, and sanitary facilities. Measures that overcome the depth to bedrock generally are prohibitively expensive.

The land capability classification is IVs. The woodland ordination symbol is 4D.

Mv—Moundhaven-Landes Variant complex, frequently flooded. These nearly level, deep soils are on flood plains. The Moundhaven soil is in the slightly higher areas and is somewhat excessively drained. The Landes Variant soil is in the slightly lower areas and is well drained. During the winter and early spring, these soils are frequently flooded for brief periods. Areas are elongated and are 10 to more than 50 acres in size. They are about 50 percent Moundhaven soil and 40 percent Landes Variant soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Moundhaven soil is dark brown loamy fine sand about 14 inches thick. The subsoil is brown, very friable loamy fine sand about 24 inches thick. The underlying material to a depth of 60 inches is brown sand. In some areas the surface layer is dark or is gravelly. In other areas it has more clay. In some places the soil has more clay in the subsoil, the underlying material, or both. In other places the slope is more than 2 percent. Some areas are underlain by gravelly sand.

In a typical profile, the surface layer of the Landes Variant soil is very dark grayish brown fine sandy loam about 14 inches thick. The subsoil is brown, friable fine sandy loam and very fine sandy loam about 25 inches thick. The underlying material to a depth of 60 inches is brown sandy loam and loamy sand. In some areas the surface layer is lighter colored depositional material or is dark and is less than 10 inches thick. In other areas the surface layer is gravelly or has less clay or more clay. In a few areas the soil has less sand and more silt throughout. In some places the subsoil contains less clay. In a few places the soil has more clay in the subsoil, the underlying material, or both. In other places the slope is more than 2 percent. Some areas are underlain by gravelly sand.

Included with these soils in mapping are areas of the somewhat poorly drained Ceresco soils and a moderately well drained soil on the lower rises and the very poorly drained Cohoctah and Cohoctah Variant soils in depressions. Some areas are frequently flooded for long periods. Included soils make up about 10 percent of the unit.

The Moundhaven soil has a low available water capacity. The Landes Variant soil has a moderate available water capacity. Permeability is rapid in the Moundhaven soil and moderately rapid in the Landes Variant soil. Organic matter content is moderate in the surface layer of the Landes Variant soil and moderately low in the Moundhaven soil. Runoff is slow.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

The Moundhaven soil is fairly well suited to corn and soybeans, and the Landes Variant soil is well suited. Flooding is a hazard on both soils, and droughtiness is a hazard in areas of the Moundhaven soil. Late planting or replanting is sometimes necessary because of the flooding. Small grain that is seeded in fall or early spring may be damaged by floodwater. Levees help to control flooding. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soils are well suited to spring-plow, spring-chisel, and no-till cropping systems.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Flooding is a hazard unless levees are constructed. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Seedling mortality, the windthrow hazard, and plant competition are the main management concerns on the Moundhaven soil. The equipment limitation and plant competition are the main management concerns on the

Landes Variant soil. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, these soils are generally unsuitable as sites for dwellings and sanitary facilities and severely limited as sites for local roads. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by flooding. Levees help to control flooding. Conveying runoff to suitable outlets reduces the wetness.

The land capability classification is IIIw. The woodland ordination symbol assigned to the Moundhaven soil is 4S, and the one assigned to the Landes Variant soil is 8W.

MwB—Mudlavia gravelly sandy loam, 1 to 3 percent slopes. This nearly level and gently sloping, deep, well drained soil is on slightly undulating terraces. Areas are elongated and are 10 to more than 200 acres in size.

In a typical profile, the surface layer is dark brown gravelly sandy loam about 9 inches thick. The subsoil is about 36 inches thick. The upper part is brown, firm very gravelly clay loam and extremely gravelly clay loam, and the lower part is dark reddish brown, firm extremely gravelly clay. The underlying material to a depth of 60 inches is brown extremely gravelly coarse sand. In some places the surface layer has more clay, is cobbly, or is darker. In other places the subsoil has less clay. In some areas the underlying material has more clay. In other areas the subsoil is shallower to calcareous sand and very gravelly coarse sand or extends to a depth of more than 70 inches. In some places gray mottles are in the subsoil. In other places calcareous glacial till is within a depth of 60 inches. In places the slope is less than 1 or more than 3 percent. Some areas have bedrock within a depth of 60 inches. Some places are not a source of sand and gravel.

Included with this soil in mapping are the excessively drained Coloma soils and the well drained Mudlavia Variant and Ormas soils in the higher or nearly level areas. Mudlavia Variant soils have limestone bedrock at a depth of 20 to 40 inches. Ormas soils are not as clayey as the Mudlavia soil and have fewer coarse fragments in the upper part of the subsoil. Also included are small areas of somewhat poorly drained soils and the very poorly drained Westland soils in the lower positions on the landscape. Included soils make up about 8 to 15 percent of the unit.

The Mudlavia soil has a low available water capacity. Permeability is moderate in the solum and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness is a hazard unless an irrigation system is used. The rock fragments are a limitation. A cropping system that includes close-growing crops helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to ridge-till and no-till cropping systems.

This soil is suited to grasses and legumes, such as bromegrass and alfalfa, for pasture. Droughtiness is a hazard unless an irrigation system is used. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the large stones and the shrink-swell potential, this soil is moderately limited as a site for

dwellings. Stones can be removed and then buried or stockpiled for future use. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling.

Because of frost action and the shrink-swell potential, this soil is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and by shrinking and swelling. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the large stones and the moderate permeability, this soil is moderately limited as a site for septic tank absorption fields. The large stones can be removed and then buried or stockpiled for future use. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderate permeability.

The land capability classification is IVe. The woodland ordination symbol is 4A.

MxA—Mudlavia Variant gravelly loam, 0 to 2 percent slopes. This nearly level, moderately deep, well drained soil is on terraces. Areas are irregular in shape and are 5 to more than 20 acres in size.

In a typical profile, the surface layer is dark brown gravelly loam about 7 inches thick. The subsoil is about 23 inches thick. The upper part is dark yellowish brown, firm very gravelly clay loam, and the lower part is brown, firm extremely cobbly clay loam. Hard limestone bedrock is at a depth of about 30 inches. In places the surface layer has more clay. Some areas have a cobbly surface. In some places the subsoil has less clay, is shallow to calcareous sand and very gravelly coarse sand, or has gray mottles. In other places the slope is more than 2 percent. In some areas the surface layer is darker. In other areas the bedrock is within a depth of 20 inches or at a depth of more than 40 inches.

Included with this soil in mapping are the well drained Milton Variant and Mudlavia soils. Milton Variant soils are higher on the landscape than the Mudlavia Variant soil. They have limestone bedrock within a depth of 20 inches. Mudlavia soils are in positions on the landscape at different levels from the Mudlavia Variant soil. They are underlain by sand and very gravelly coarse sand. Also included are small areas of somewhat poorly drained soils in the lower positions on the landscape and areas of the very poorly drained Millsdale soils in depressions. Included soils make up about 8 to 15 percent of the unit.

The Mudlavia Variant soil has a very low available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Crusting is a problem. Droughtiness and the rock fragments are limitations. Irrigation helps to overcome droughtiness. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to ridge-till and no-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Droughtiness is a hazard unless an irrigation system is used. Drought-tolerant species grow best. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional

management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of large stones, the shrink-swell potential, and the depth to bedrock, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the depth to bedrock. The stones can be removed and disposed of or stockpiled for future use. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Measures that overcome the depth to bedrock generally are prohibitively expensive.

Because of the depth to bedrock, frost action, and the shrink-swell potential, this soil is moderately limited as a site for local roads and streets. Measures that overcome the depth to bedrock generally are prohibitively expensive. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action. Strengthening or replacing the base material with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the depth to bedrock and seepage, this soil is generally unsuitable as a site for septic tank absorption fields. Measures that overcome the depth to bedrock generally are prohibitively expensive.

The land capability classification is IIIs. The woodland ordination symbol is 4F.

OdA—Ockley silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on broad terraces. Areas generally are irregular in shape, but along streams they are elongated. They are 5 to more than 100 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 47 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the next part is brown, firm clay loam and gravelly sandy clay loam; and the lower part is dark brown, firm gravelly clay loam. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. In some areas the surface layer is cobbly, and in other areas it is gravelly loam, gravelly sandy loam, or sandy loam. In a few areas the surface layer is darker, and in other areas it contains more clay. In places the subsoil has less clay. In some areas the underlying material has more clay. In other areas it has gray mottles. In some places the lower part of the subsoil is loamy sand. In a few places the silty material is as much as 30 inches thick. In other places calcareous glacial till is within a depth of 60 inches. In some areas sand and gravelly coarse sand is within a depth of 40 inches. In other areas the slope is more than 2 percent. In places bedrock is within a depth of 60 inches. Some areas are not a source of sand and gravel.

Included with this soil in mapping are the very poorly drained Westland soils in depressions and the somewhat poorly drained Sleeth and Waynetown soils in the lower positions on the landscape. Also included are small areas of the well drained Rush soils at different levels on the landscape and the well drained Fox soils in the more sloping areas. Rush soils have a thicker silt deposit than the Ockley soil. Fox soils are deeper to the very gravelly coarse sand than the Ockley soil. Included soils make up about 5 to 10 percent of the unit.

The Ockley soil has a high available water capacity. Permeability is moderate in the subsoil and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a problem. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting

mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling.

Because of the shrink-swell potential and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic.

This soil is suitable as a site for septic tank absorption fields.

The land capability classification is I. The woodland ordination symbol is 5A.

OdB2—Ockley silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on rises and side slopes on terraces. Areas are elongated or irregular in shape and are 5 to more than 30 acres in size.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. It contains dark yellowish brown subsoil material. The subsoil is about 44 inches thick. In sequence downward, it is dark yellowish brown, firm silty clay loam; dark yellowish brown and brown, firm clay loam; dark brown, firm sandy clay loam; dark yellowish brown and reddish brown, firm gravelly sandy clay loam; and reddish brown or dark reddish brown, firm very gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. The underlying material is extremely variable within a short distance. It ranges from gravelly coarse sand to fine sand and silt. In a few areas the surface layer is sandy loam. In other areas it is darker. In places gravelly coarse sand is above a depth of 40 inches. In a few areas the silty material is more than 24 inches thick. In other areas glacial till is within a depth of 60 inches. In some places the slope is less than 2 or more than 6 percent. Some areas are not a source of sand and gravel.

Included with this soil in mapping are the very poorly drained Westland soils in depressions and the well drained Fox soils in the more sloping areas. Fox soils are deeper to the very gravelly coarse sand than the Ockley soil. Included soils make up about 10 to 15 percent of the unit.

The Ockley soil has a moderate available water capacity. Permeability is moderate in the subsoil and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems (fig. 10).

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling.

Figure 10.—The no-till cropping system helps to control erosion on Ockley silt loam, 2 to 6 percent slopes, eroded.

Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of the shrink-swell potential and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic.

This soil is suitable as a site for septic tank absorption fields.

The land capability classification is IIe. The woodland ordination symbol is 5A.

OfB2—Ockley loam, till substratum, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on rises and side slopes on outwash plains. Areas are mostly irregular in shape, but along streams some are elongated. They are 3 to more than 30 acres in size.

In a typical profile, the surface layer is dark brown loam about 9 inches thick. It contains 20 percent brown subsoil material. The subsoil is about 48 inches thick. The upper part is brown, firm sandy clay loam, and the lower part is brown and dark brown, firm gravelly sandy clay loam. The underlying material to a depth of 70 inches is yellowish brown loam. In some places the surface layer is silt loam, sandy loam, gravelly loam, or gravelly sandy loam. In a few small severely eroded areas, it has more clay. In places the underlying material above the firm loam till or the lower part of the subsoil is gravelly coarse sand, silt loam, sand, and fine sand. In a few areas the firm loam till is within a depth of 40 inches. In other areas a 3- to 10-inch layer that has developed in the glacial till forms the lower part of the subsoil. In some places gray mottles are at a depth of 30 inches. In other places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are the well drained Alvin, Fox, and Kendallville soils on ridges and knolls. Alvin and Kendallville soils have less clay in the solum than the Ockley soil. Fox soil is deeper to the very gravelly coarse sand than the Ockley soil. Included soils make up about 10 to 15 percent of the unit.

The Ockley soil has a moderate available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. Erosion can be minimized by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion and runoff are hazards. Overgrazing causes erosion and reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and a rotation grazing system in which grazing periods are shortened during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by cutting, spraying, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of the shrink-swell potential and frost action, this soil is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic and help to prevent the damage caused by frost action.

Because of the moderate permeability, this soil is moderately limited as a site for septic tank absorption fields. Enlarging the absorption field, installing the absorption field into a mound system, or using a holding tank minimizes the adverse effects of the moderate permeability.

The land capability classification is IIe. The woodland ordination symbol is 5A.

OgA—Ockley-Rush silt loams, till substrata, 0 to 2 percent slopes. These nearly level, deep, well drained soils are on outwash plains. The Ockley soil is in the slightly higher areas. Areas are irregular in shape and are 3 to more than 150 acres in size. They are about 45 percent Ockley soil and 40 percent Rush soil. Both soils have a till substratum. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Ockley soil is dark brown silt loam about 9 inches thick. The subsoil is about 52 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the next part is brown, firm clay loam; and the lower part is dark brown, firm gravelly clay loam. The underlying material to a depth of 70 inches is yellowish brown loam. In some places the surface layer is darker, and in other places it is gravelly. In some areas the underlying material above the firm glacial till or the lower part of the subsoil is gravelly coarse sand, silt loam, sand, and fine sand. In a few places the firm loam till is within a depth of 40 inches. In other places a 3- to 10-inch layer that has developed in the glacial till forms the lower part of the subsoil. In some areas gray mottles are at a depth of 30 inches. In other areas the slope is more than 2 percent.

In a typical profile, the surface layer of the Rush soil is dark brown silt loam about 9 inches thick. The subsoil is 45 inches thick. In sequence downward, it is dark yellowish brown, firm silty clay loam; brown, firm clay loam and gravelly sandy clay loam; dark brown, friable gravelly sandy loam; and dark brown, firm gravelly sandy clay loam. The upper part of the underlying material is brown, very gravelly loamy coarse sand. The lower part to a depth of 65 inches is yellowish brown loam. In some places the surface layer is darker. In other places the underlying material above the firm glacial till or the lower part of the subsoil is silt loam, sand, and fine sand. In some areas the deposit of silty material is thicker. In a few places the firm glacial till is within a depth of 40 inches. In other places a 3- to 10-inch layer that has developed in the glacial till forms the lower part of the subsoil. In some areas gray mottles are at a depth of 30 inches. In other areas the slope is more than 2 percent.

Included with these soils in mapping are the well drained Alvin soils on ridges and knolls and some somewhat poorly drained soils on foot slopes and in the slightly lower areas. Alvin soils have less clay than the Ockley and Rush soils. Included soils make up about 15 percent of the unit.

The Ockley and the Rush soils have a high available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are well suited to corn, soybeans, and small grain. Crusting is a problem. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to no-till and ridge-till cropping systems.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, timely application of nutrients, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is severe on the Rush soil. Seedlings can survive and grow well, however, if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, these soils are moderately limited as sites for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling.

Because of frost action and the shrink-swell potential, the Ockley soil is moderately limited as a site for local roads and streets. The Rush soil is severely limited because of low strength and frost action. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic and help to prevent the damage caused by frost action.

Because of the moderate permeability, the Ockley soil is moderately limited as a site for septic tank absorption fields and the Rush soil is severely limited. Enlarging the absorption field, installing the absorption field into a mound system, or using a holding tank minimizes the adverse effects of the moderate permeability.

The land capability classification is I. The woodland ordination symbol assigned to the Ockley soil is 5A, and the one assigned to the Rush soil is 8A.

OhC3—Ockley, till substratum-Kendallville clay loams, 6 to 12 percent slopes, severely eroded. These moderately sloping, deep, well drained soils are on side slopes on outwash plains. Areas are mostly irregular in shape, but along streams some are elongated. They are 3 to 20 acres in size. The areas are about 60 percent Ockley soil and 25 percent Kendallville soil. The Ockley soil has a till substratum. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Ockley soil is dark brown clay loam about 7 inches thick. The subsoil is about 47 inches thick. The upper part is dark brown, firm clay loam; the next part is dark brown, firm gravelly sandy clay loam; and the lower part is very dark brown, firm gravelly clay loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the surface layer is sandy loam or gravelly clay loam. In other places thin layers of gravelly coarse sand, silt loam, sand, and fine sand are directly above the firm glacial till. In some areas a 3- to 10-inch layer that has developed in the glacial till forms the lower part of the subsoil. In other areas gray mottles are at a depth of 30 inches. In places the slope is less than 6 or more than 12 percent.

In a typical profile, the surface layer of the Kendallville soil is dark brown clay loam about 7 inches thick. The subsoil is about 27 inches thick. The upper part is dark brown, firm gravelly clay loam, and the lower part is dark yellowish brown, firm clay loam and loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some areas the subsoil extends to a depth of more than 40 inches. In other areas gray mottles are at a depth of 30 inches. In places the slope is less than 6 or more than 12 percent.

Included with these soils in mapping are somewhat poorly drained soils in the lower areas and the well drained Rush soils in the less sloping, higher areas. Rush soils are those that have a till substratum. They have a thicker deposit of silty material on the surface than the Ockley and Kendallville soils. Included soils make up about 15 percent of the unit.

The Ockley soil has a high available water capacity. The Kendallville soil has a moderate available water capacity. Permeability is moderate in the Ockley soil. It is moderate in the upper part of the solum in the Kendallville soil and moderately slow in the lower part of the solum and in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are poorly suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. Erosion can be minimized by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to no-till and ridge-till cropping systems.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for pasture. They are fairly well suited to hay crops. Erosion and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is severe. Seedlings can survive and grow well, however, if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential and the slope, these soils are moderately limited as sites for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Wetness may be a problem if the lower part of a basement is constructed in firm glacial till. A subsurface drainage system of perimeter interceptor drains can reduce the wetness. The buildings should be constructed in the less sloping areas or designed so

that they conform to the natural slope of the land. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of frost action, the shrink-swell potential, and the slope, these soils are moderately limited as sites for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by shrinking and swelling and by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action. Cuts and fills can reduce the slope. Constructing the roads and streets on the contour helps to overcome the slope.

Because of the moderate permeability and the slope, the Ockley soil is moderately limited as a site for septic tank absorption fields. The Kendallville soil is severely limited because of the moderately slow permeability. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the restricted permeability. In areas of the Kendallville soil, lateral seepage at the top of the glacial till can result in the surfacing of effluent. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 5A.

OrA—Ormas loamy sand, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on terraces. Areas are irregular in shape and are 5 to more than 50 acres in size.

In a typical profile, the surface layer is dark yellowish brown loamy sand about 9 inches thick. The subsurface layer is brown and yellowish brown loamy sand about 24 inches thick. The subsoil is about 22 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is dark brown, firm gravelly sandy clay loam. The underlying material to a depth of 70 inches is brown very gravelly coarse sand. Some areas are shallower to gravelly coarse sand. In some places the surface layer is darker. In other places the combined surface and subsurface layers are thinner or are more than 40 inches thick. In some areas the slope is more than 2 percent. In other areas thin bands are in the lower part of the subsurface layer. In places the lower part of the subsoil is gravelly clay loam. Some areas are not a source of sand and gravel.

Included with this soil in mapping are small areas of the excessively drained Coloma soils and the well drained Mudlavia and Fox soils. Mudlavia soils are in the lower areas. They have more clay and coarse fragments in the subsoil than the Ormas soil. Fox soils are more sloping than the Ormas soil. They have sand and gravel within a depth of 40 inches. Included soils make up about 8 to 12 percent of the unit.

The Ormas soil has a low available water capacity. Permeability is rapid or moderately rapid in the solum and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Droughtiness and soil blowing are hazards unless an irrigation system and windbreaks are used. A cropping system that includes close-growing crops helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Drought-tolerant species grow best. Droughtiness and soil blowing are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. An irrigation system can control the droughtiness. A cover of grasses and legumes helps to control soil blowing. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are seedling mortality and plant competition. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs

can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

This soil is suitable as a site for dwellings. Because of frost action, it is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of poor filtering qualities, this soil is severely limited as a site for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OrB—Ormas loamy sand, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on rises and side slopes on terraces. Areas are irregular in shape and are 5 to more than 20 acres in size.

In a typical profile, the surface layer is dark yellowish brown loamy sand about 9 inches thick. The subsurface layer is about 23 inches thick. The upper part is dark yellowish brown loamy sand, and the lower part is yellowish brown sand. The subsoil is about 24 inches thick. In sequence downward, it is dark brown, friable sandy loam; dark brown, friable gravelly sandy loam; dark brown, firm gravelly sandy clay loam; and dark brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches is yellowish brown very gravelly coarse sand. Some areas are shallower to gravelly coarse sand. In some places the surface layer is darker. In other places the combined surface and subsurface layers are thinner or are more than 40 inches thick. In some areas the slope is less than 2 or more than 6 percent. In other areas thin bands are in the lower part of the subsurface layer. Some places are not a source of sand and gravel.

Included with this soil in mapping are small areas of the excessively drained Coloma soils and the well drained Fox and Mudlavia soils. Coloma and Fox soils are in the more sloping areas. Coloma soils have subsoil material in the form of lamellae and are not underlain by sand and gravel. Fox soils are underlain by sand and gravel within a depth of 40 inches. Mudlavia soils are in the lower areas. They have more clay and coarse fragments than the Ormas soil. Included soils make up about 8 to 12 percent of the unit.

The Ormas soil has a low available water capacity. Permeability is rapid or moderately rapid in the solum and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Droughtiness, soil blowing, and erosion are hazards. An irrigation system helps to overcome droughtiness. Windbreaks help to control soil blowing. Erosion can be minimized by diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops helps to control soil blowing and water erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Droughtiness and soil blowing are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A cover of grasses and legumes helps to control soil blowing and water erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are seedling mortality and plant competition. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if

competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

This soil is suitable as a site for dwellings. Because of frost action, it is moderately limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of poor filtering qualities, this soil is severely limited as a site for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies may become a problem. Installing the absorption field into a mound system increases the filtering capacity.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

Pb—Palms muck, drained. This nearly level, deep, very poorly drained soil is in depressions on terraces, till plains, and outwash plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape or circular and are 3 to more than 15 acres in size.

In a typical profile, the surface layer is black muck about 10 inches thick. The organic material extends to a depth of about 19 inches. It is black muck. The upper part of the underlying material is very dark gray and dark gray, mottled silt loam. The next part is gray, mottled silt loam. The lower part to a depth of 60 inches is gray, mottled silty clay loam stratified with silt loam. In a few places fires have destroyed much of the organic matter. In other places the organic layer is as thin as 10 inches. In some areas thin layers of coprogenous earth are at a depth of 20 inches. In other areas the organic material is thicker than 51 inches. In a few places the underlying material is sand or marl.

Included with this soil in mapping are small areas of the poorly drained Pella soils and the very poorly drained Milford and Wallkill soils in the slightly higher positions on the landscape. Milford and Wallkill soils have less organic matter in the surface layer than the Palms soil. Also included on flood plains are areas of soils that are frequently or occasionally flooded and areas that are saturated most of the year and on which the dominant vegetation is wetland weeds. Included soils make up about 10 to 15 percent of the unit.

The Palms soil has a very high available water capacity. Permeability is moderately slow to moderately rapid in the organic layers and moderately slow or moderate in the mineral material. Organic matter content is very high in the surface layer. Runoff is ponded or very slow. The water table is at or above the surface from late fall through spring.

Most areas of this soil are drained and are used for cultivated crops. Some are used for pasture or woodland. Undrained areas provide habitat for wetland wildlife.

If drained, this soil is fairly well suited to corn and soybeans. Wetness is a limitation, and ponding is a hazard. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established for row crops. The wetness and the ponding can hinder the use of farm equipment. Open ditches, subsurface drains with adequate outlets, pumps, or a combination of these can remove excess water. Overdrainage can result in accelerated subsidence of the muck. Raising the water table during fallow periods slows the rate of subsidence. The organic material is susceptible to burning when dry. Soil blowing is a hazard in large drained and cultivated areas unless a system of conservation tillage that leaves protective amounts of crop residue on the surface is used. The soil is well suited to spring plowing.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is the main limitation. The ponding, frost heaving, and the soil blowing are hazards. A cover of grasses is effective in controlling soil blowing. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in reduced forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to maintain good plant density and hardiness and keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the

trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding and the subsidence, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, the subsidence, and frost action. Removing the unstable material, constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action, remove excess water, and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Pd—Palms muck, cobbly substratum, drained. This nearly level, deep, very poorly drained soil is in depressions on terraces. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are elongated and are 5 to more than 30 acres in size.

In a typical profile, the surface layer is black muck about 8 inches thick. The organic material extends to a depth of 42 inches. It is black and dark reddish brown muck. The upper part of the underlying material is black cobbly loam. The lower part to a depth of 60 inches is gray, mottled cobbly loam. In a few places fires have destroyed much of the organic matter. In some places the organic layer is as thin as 10 inches or is thicker than 51 inches. In other places thin layers of coprogenous earth are at a depth of 20 inches. In some areas the underlying material is sand or marl.

The Palms soil has a very high available water capacity. Permeability is moderate or moderately rapid in the organic layers and moderate in the underlying material. Organic matter content is very high in the surface layer. Runoff is ponded or very slow. The water table is at or above the surface from late fall through spring.

Most areas of this soil are drained and are used for cultivated crops. Some are used for pasture or woodland. Undrained areas provide habitat for wetland wildlife.

If drained, this soil is fairly well suited to corn and soybeans. Wetness is the main limitation, and ponding is a hazard. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established for row crops. The wetness and the ponding can hinder the use of farm equipment. Open ditches, subsurface drains with adequate outlets, pumps, or a combination of these can remove excess water. Overdrainage can result in accelerated subsidence of the muck. Raising the water table during fallow periods slows the rate of subsidence. The organic material is susceptible to burning when dry. In large areas that are not protected when they are drained and cultivated, soil blowing is a hazard. It can be controlled by a system of conservation tillage that leaves protective amounts of crop residue on the surface. The soil is well suited to spring plowing.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is the main limitation. The ponding, frost heaving, and the soil blowing are hazards. A cover of grasses is effective in controlling soil blowing. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in reduced forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to maintain good plant density and hardiness and keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is

controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding and the subsidence, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, the subsidence, and frost action. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action, reduce the wetness, and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets reduces the wetness and the potential for frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Pe—Palms Variant muck, drained. This nearly level, moderately deep, very poorly drained soil is in depressions on terraces. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape and are 5 to 40 acres in size.

In a typical profile, the upper 32 inches is black muck. The underlying material is dark grayish brown silty clay loam about 4 inches thick. Limestone bedrock is at a depth of about 36 inches. In some places thin layers of coprogenous earth are at a depth of about 20 inches. In other places the organic material is as thin as 10 inches or is thicker than 51 inches. In a few areas the underlying material above the bedrock is sand or marl.

Included with this soil in mapping are small areas of the very poorly drained Millsdale soils on the slightly higher parts of the landscape. These soils have less organic matter in the surface layer than the Palms Variant soil. Also included are areas where the soil is saturated most of the year and the dominant vegetation is wetland weeds. Included soils make up about 10 to 15 percent of the unit.

The Palms Variant soil has a very high available water capacity. Permeability is moderately rapid in the organic layers and moderately slow in the mineral underlying material. Organic matter content is very high in the surface layer. Runoff is ponded or very slow. The water table is at or above the surface from late fall through spring.

Most areas of this soil are drained and are used for cultivated crops. Some are used for pasture or woodland. Undrained areas provide habitat for wetland wildlife.

If drained, this soil is fairly well suited to corn and soybeans. Wetness is the main limitation, and ponding is a hazard. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established for row crops. The wetness and the ponding can hinder the use of farm equipment. Open ditches, subsurface drains and outlets, pumps, or a combination of these can remove excess water. Overdrainage can result in accelerated subsidence of the muck. Raising the water table during fallow periods slows the rate of subsidence. The organic part of the soil is susceptible to burning when dry. In large areas that are not protected when they are drained and cultivated, soil blowing is a hazard. It can be controlled by a system of conservation tillage that leaves protective amounts of crop residue on the surface. The soil is well suited to spring plowing.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. Water-tolerant species grow best. The wetness is the main limitation. The ponding, the soil blowing, and frost heaving are hazards. A cover of grasses is effective in controlling soil blowing. A drainage system increases forage yields. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which reduces plant density and hardiness. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is

controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. Alternative sites should be selected. Because of the ponding, the subsidence, and frost action, the soil is severely limited as a site for local roads. Removing the unstable material, constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, constructing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action, remove excess water, and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets helps to prevent the damage caused by ponding and by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Pg—Patton silty clay loam. This nearly level, deep, poorly drained soil is in broad depressions on outwash plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are elongated, circular, oblong, or irregular in shape and are 5 to more than 100 acres in size.

In a typical profile, the surface soil is very dark gray silty clay loam about 14 inches thick. The subsoil is about 40 inches thick. It is dark gray and dark grayish brown, mottled, firm silty clay loam in the upper part; grayish brown, mottled, firm silty clay loam in the next part; and gray, mottled, firm silty clay loam in the lower part. The upper part of the underlying material is gray, mottled silt loam stratified with silty clay loam. The lower part to a depth of 65 inches is grayish brown, mottled silty clay loam stratified with silt loam. In some places the subsoil has less clay. In other places the silty material is more than 60 inches thick. In some areas the dark surface layer is less than 10 inches thick, and in other areas the surface layer is lighter colored depositional material or is mucky silt loam, mucky silty clay loam, or muck. In some places the surface layer has more clay. In other places calcareous, firm glacial till is within a depth of 60 inches. In a few places the underlying material has thin layers of organic deposits, marl, and snail shells. In some areas the slope is more than 2 percent. In a few areas the underlying material is sandy loam, loam, and loamy sand. In other areas the surface layer and subsoil contain more sand and less silt. Some areas are underlain by calcareous sand and gravelly sand. In places the depth to the subsoil is less than 40 inches.

Included with this soil in mapping are areas of the well drained Camden soils in the higher positions on the landscape and the somewhat poorly drained Kendall and Starks soils on slight rises. Also included are some undrained areas that remain wet most of the year and small areas of muck soils in deep depressions. Included soils make up about 5 to 15 percent of the unit.

The Patton soil has a high available water capacity. Permeability is moderate in the subsoil and moderately slow in the underlying material. Organic matter content is high in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface during the winter and early spring. The surface layer becomes cloddy and hard to work if it is tilled when too wet.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the

summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Maintaining a crown in roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. Providing coarse textured subgrade or base material helps to prevent the damage caused by low strength and by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Pk—Pella silty clay loam. This nearly level, deep, poorly drained soil is in depressions on till plains, terraces, and outwash plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape and are 5 to more than 20 acres in size.

In a typical profile, the surface soil is black silty clay loam about 15 inches thick. The subsoil is about 22 inches thick. The upper part is grayish brown and gray, mottled, firm silty clay loam, and the lower part is olive gray, mottled, firm silty clay loam. The upper part of the underlying material is gray, mottled silt loam. The lower part to a depth of 60 inches is gray, mottled silt loam stratified with thin layers of sandy loam. In some places the subsoil has more clay. In other places the dark surface layer is less than 10 inches thick. In some areas the surface layer is lighter colored depositional material or is mucky silty clay loam, mucky silt loam, or muck. In other areas, the surface layer is not dark and the subsoil has less clay. In some places calcareous glacial till is within a depth of 60 inches. In other places the soil is not calcareous above a depth of 40 inches. In some areas the underlying material is sandy and loamy glacial outwash. In a few areas it has thin layers of organic deposits, marl, and snail shells. In places the silty material is more than 60 inches thick.

Included with this soil in mapping are a few areas that are undrained. Also included are areas of the very poorly drained Houghton and Palms soils in the deeper depressions. These soils formed in organic deposits. Included soils make up less than 10 percent of the unit.

The Pella soil has a high available water capacity. Permeability is moderate. Organic matter content is high in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface during the winter and early spring. The surface layer becomes cloddy and hard to work if it is tilled when too wet.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, woodland, or habitat for wildlife.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or both. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. Cover crops, green manure crops, and a system of conservation tillage that leaves protective amounts of crop residue on the surface help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and

shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Maintaining a crown in roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. A coarse grained subgrade or base material helps to prevent the damage caused by low strength and by frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

PnB—Piankeshaw Variant gravelly sandy loam, rarely flooded, 2 to 8 percent slopes. This gently sloping, deep, well drained soil is on alluvial fans. It is subject to rare flooding. Areas are irregular in shape or elongated and are 5 to more than 50 acres in size.

In a typical profile, the surface layer is dark brown gravelly sandy loam about 8 inches thick. The subsurface layer is dark brown very gravelly sandy loam about 8 inches thick. The upper part of the underlying material is dark yellowish brown and brown very gravelly and gravelly sandy loam. The next part is brown very gravelly loamy coarse sand. The lower part to a depth of 60 inches is dark yellowish brown gravelly sandy loam. In some areas the surface layer is cobbly, and in other areas it has more clay. In some places the upper part of the underlying material has less clay. In other places sand and gravelly sand are at a depth of 20 inches. In some areas calcareous glacial till is within a depth of 60 inches. In other areas the soil has gray mottles. In some places the slope is less than 2 or more than 8 percent.

Included with this soil in mapping are the very poorly drained Warners Variant soils near the bottom of very steep slopes. They make up about 5 to 15 percent of the unit.

The Piankeshaw Variant soil has a low available water capacity. Permeability is moderately rapid. Organic matter content is moderately low in the surface layer. Runoff is medium.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness, erosion, and runoff are hazards. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for pasture. It is fairly well suited to hay crops. Drought-tolerant species grow best. Erosion, droughtiness, and runoff are hazards. A cover of grasses and legumes helps to control water erosion. An irrigation system can overcome droughtiness. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation and seedling mortality. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is moderately limited as a site for local roads because

of the flooding, large stones, and frost action. Constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by flooding and by frost action. Levees help to control flooding. The stones can be removed and disposed of or stockpiled for future use.

The land capability classification is IVs. The woodland ordination symbol is 3F.

Pp—Pits, gravel. These nearly level to steep, well drained areas are on terraces, outwash plains, and bottom land where sand and gravel have been excavated. The areas are irregular in shape and are 2 to 10 acres in size.

In a typical unit, the soil material has been removed and sand and gravel are exposed. The layers of very gravelly coarse sand and gravelly coarse sand are variable in thickness. In places soil material has washed into the pits and supports a sparse cover of vegetation.

Included in mapping are small areas where the overburden has been piled and now supports a cover of vegetation; some small pits on the uplands where all the gravel has been removed and the calcareous glacial till is exposed; areas where water covers the lowest part of the pit; and a few areas where soil and manmade material have been dumped into the pits. Included areas make up about 10 to 15 percent of the unit.

The available water capacity is low. Permeability is moderate to very rapid. Organic matter content is very low. Reaction is moderately alkaline. Tilth is poor. Runoff is very slow to very rapid. A high water table is in some areas.

These areas are not used for cultivated crops and support little or no vegetation. They are generally unsuited to cultivated crops. Major land reclamation is needed before they can be cropped or made suitable for hay or pasture. Erosion is a hazard on the sloping parts of the unit. Onsite investigation of soil properties and engineering test data is needed before structures are designed.

No land capability classification or woodland ordination symbol is assigned.

Pr—Pits, quarry. These pits are on bedrock terraces where limestone has been quarried. The limestone is crushed and used for roads and agricultural limestone.

In a typical unit of a limestone quarry, the face is hard, thin- to thick-bedded, gray limestone. In places, soil material has been washed into the quarry and supports a sparse cover of vegetation. Many of the sides are vertical.

Included in mapping are small areas of water; areas around the edge of the pits where the overburden has been piled and now supports sparse vegetation; and a few areas where manmade rubbish has been dumped into the pit.

The available water capacity is very low. Permeability is very slow to moderately rapid. Organic matter content is very low. Runoff is very slow to very rapid. Bedrock is exposed in most areas of the unit.

Most areas support little or no vegetation. Major land reclamation is needed before the areas can support adequate vegetation.

No land capability classification or woodland ordination symbol is assigned.

RmB2—Riddles-Miami loams, 2 to 6 percent slopes, eroded. These gently sloping, deep, well drained soils are on rises and side slopes on rolling till plains and moraines. The Miami soil is in the more sloping areas. Areas are irregular in shape and are 5 to more than 40 acres in size. They are about 55 percent Riddles soil and 30 percent Miami soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Riddles soil is brown loam about 8 inches thick. It contains about 20 percent dark yellowish brown subsoil material. The subsoil is about 58 inches thick. In sequence downward, it is dark yellowish brown, firm clay loam; dark yellowish brown, friable sandy loam; dark yellowish brown, firm clay loam; dark yellowish brown, firm sandy clay loam; and dark yellowish brown, firm clay loam. The underlying material to a depth of 80 inches is brown loam. In some eroded areas the surface layer has more clay. In a few places the surface layer and the upper part of the subsoil are silty. In some areas the underlying material is loamy glacial outwash. In a few areas a thin layer of calcareous gravelly coarse sand, gravelly loamy sand, or loamy sand is directly above the underlying glacial till. In other areas the lower part of the subsoil is mottled. In places the slope is less than 2 or more than 6 percent.

In a typical profile, the surface layer of the Miami soil is brown loam about 8 inches thick. It contains about 25 percent dark yellowish brown subsoil material. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, firm clay loam, and the lower part is brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places

the lower part of the subsoil is mottled. In other places the subsoil has less clay or is loamy glacial outwash underlain by glacial till. In some areas the slope is less than 2 or more than 6 percent.

Included with these soils in mapping are the somewhat poorly drained Crosier and Whitaker soils in the lower areas. Also included are the well drained Alvin soils in positions on the landscape similar to those of the Riddles and Miami soils. They have less clay in the subsoil than the Riddles and Miami soils. Included soils make up about 15 percent of the unit.

The Riddles soil has a high available water capacity. The Miami soil has a moderate available water capacity. Permeability is moderate in the Riddles soil. It is moderate in the subsoil of the Miami soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. Erosion can be minimized by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. Cover crops, green manure crops, and a system of conservation tillage that leaves crop residue on the surface help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to no-till and ridge-till cropping systems.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion and runoff are hazards. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, reduce surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, these soils are moderately limited as sites for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Wetness may be a problem if the lower part of a basement is constructed in firm glacial till. A subsurface drainage system of perimeter interceptor drains can reduce the wetness. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of the shrink-swell potential and low strength, the Riddles soil is moderately limited as a site for local roads and streets. The Miami soil is severely limited because of low strength. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic.

Because of the moderate permeability, the Riddles soil is moderately limited as a site for septic tank absorption fields. The Miami soil is severely limited because of the moderately slow permeability. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 5A.

RmD2—Riddles-Miami loams, 12 to 18 percent slopes, eroded. These strongly sloping, deep, well drained soils are on side slopes on rolling till plains and moraines. The Miami soil is in the more sloping areas. Areas are irregular in shape and are 3 to 30 acres in size. They are about 50 percent Riddles soil and 35 percent Miami soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Riddles soil is brown loam about 8 inches thick. It contains

about 20 percent dark yellowish brown subsoil material. The subsoil is about 56 inches thick. The upper part is dark yellowish brown and dark brown, firm clay loam; the next part is dark brown, friable sandy loam; and the lower part is dark brown, firm sandy clay loam. The underlying material to a depth of 80 inches is yellowish brown loam. In a few places the underlying material is loamy glacial outwash. In some areas a thin layer of calcareous gravelly coarse sand, gravelly loamy sand, or loamy sand is directly above the underlying glacial till. In other areas the slope is less than 12 or more than 18 percent.

In a typical profile, the surface layer of the Miami soil is brown loam about 8 inches thick. It contains about 20 percent dark yellowish brown subsoil material. The subsoil is dark yellowish brown, firm clay loam about 24 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the subsoil is loamy glacial outwash directly above the underlying glacial till. In other places the soil has less clay in the surface layer, the subsoil, or both. In some areas the calcareous glacial till is within a depth of 24 inches. In other areas the slope is less than 12 or more than 18 percent.

Included with these soils in mapping are the somewhat poorly drained Crosier and Whitaker soils on foot slopes and in drainageways. Included soils make up about 15 percent of the unit.

The Riddles soil has a high available water capacity. The Miami soil has a moderate available water capacity. Permeability is moderate in the Riddles soil. It is moderate in the subsoil of the Miami soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is rapid.

Most areas of these soils are used as pasture or woodland. Some are used for hay or cultivated crops.

These soils are poorly suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. In some areas small gullies hinder the use of farm machinery. Erosion can be minimized by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. Cover crops, green manure crops, and a system of conservation tillage that leaves crop residue on the surface help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for pasture. They are fairly well suited to hay crops. Erosion and runoff are hazards. Operating some types of equipment on the steeper slopes can be hazardous. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A system of conservation tillage that leaves crop residue on the surface should be used to establish or renovate pastures. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. The erosion hazard, the equipment limitation, and plant competition are the main management concerns. Logging roads, skid trails, and landings should be located on gentle grades. Water bars, culverts, and drop structures minimize erosion. Special logging methods, such as yarding the logs with a cable, may be needed because of the slope. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the slope, these soils are severely limited as sites for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of low strength and the slope, these soils are severely limited as sites for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic. Cuts and fills can reduce the slope. The roads should be constructed on the contour where possible.

Because of the slope, the Riddles soil is severely limited as a site for septic tank absorption fields. The

Miami soil is severely limited because of the slope and the moderately slow permeability. In most areas of the Miami soil, lateral seepage at the top of the glacial till can result in the surfacing of effluent. Installing the absorption field on the contour helps to overcome the slope. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability.

The land capability classification is IVe. The woodland ordination symbol is 5R.

RnC3—Riddles-Miami complex, 6 to 12 percent slopes, severely eroded. These moderately sloping, deep, well drained soils are on side slopes on rolling till plains and moraines. The Miami soil is in the more sloping areas. Areas are irregular in shape and are 3 to more than 30 acres in size. They are about 45 percent Riddles soil and 40 percent Miami soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Riddles soil is brown loam about 7 inches thick. The subsoil is about 55 inches thick. In sequence downward, it is brown and dark brown, firm clay loam; dark yellowish brown, firm clay loam; dark brown, friable sandy loam; dark brown, firm sandy clay loam; and dark yellowish brown, firm clay loam. The underlying material to a depth of 70 inches is brown loam. In a few places the underlying material is loamy glacial outwash. In some areas a thin layer of calcareous gravelly coarse sand, gravelly loamy sand, or loamy sand is directly above the underlying glacial till. In places the slope is less than 6 or more than 12 percent.

In a typical profile, the surface layer of the Miami soil is dark yellowish brown clay loam about 6 inches thick. The subsoil is dark yellowish brown, firm clay loam about 22 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the subsoil is stratified loamy outwash directly above the underlying glacial till. In other places the soil has less clay in the surface layer, the subsoil, or both. In some areas the calcareous glacial till is within a depth of 24 inches. In other areas the slope is less than 6 or more than 12 percent.

Included with these soils in mapping are the somewhat poorly drained Crosier and Whitaker soils on foot slopes and in drainageways. Included soils make up about 15 percent of the unit.

The Riddles soil has a high available water capacity. The Miami soil has a moderate available water capacity. Permeability is moderate in the Riddles soil. It is moderate in the subsoil of the Miami soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium. The surface layer of the Miami soil becomes cloddy and hard to work if it is tilled when too wet.

Most areas of these soils are used for cultivated crops. Some are used for hay, pasture, or woodland.

These soils are poorly suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. Erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to no-till and ridge-till cropping systems.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for pasture. They are fairly well suited to hay crops. Erosion and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential and the slope, these soils are moderately limited as sites for dwellings. Strengthening foundations, footings, and basement

walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. Wetness may be a problem if the lower part of a basement is constructed in firm glacial till. A subsurface drainage system of perimeter interceptor drains can reduce the wetness. The buildings should be constructed in the less sloping areas or designed so that they conform to the natural slope of the land. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of the slope, the shrink-swell potential, and low strength, the Riddles soil is moderately limited as a site for local roads and streets. The Miami soil is severely limited because of low strength. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts improve the ability of the roads and streets to support vehicular traffic. Cuts and fills can reduce the slope. The roads should be constructed on the contour where possible.

Because of the moderate permeability and the slope, the Riddles soil is moderately limited as a site for septic tank absorption fields. The Miami soil is severely limited because of the moderately slow permeability. In most areas of the Miami soil, lateral seepage at the top of the glacial till can result in the surfacing of effluent. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the restricted permeability. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 5A.

RoA—Rockfield silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on slight rises on till plains. Areas are irregular in shape and are 3 to 30 acres in size.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 48 inches thick. In sequence downward, it is dark yellowish brown, firm silty clay loam; dark brown, mottled, firm clay loam and sandy clay loam; brown, mottled, friable sandy loam; and dark yellowish brown and brown, mottled, firm clay loam and loam. The underlying material to a depth of 65 inches is yellowish brown loam. In some places the soil has less clay in the subsoil, the underlying material, or both. In other places the silty material is more than 40 inches thick. In a few places the surface layer is darker. In some areas, glacial till is at a depth of more than 60 inches and the underlying material is stratified sandy and loamy glacial outwash. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Fincastle soils on slight rises and the moderately well drained Williamstown soils along drainageways. Williamstown soils formed in a thinner deposit of silty material than the Rockfield soil. Included soils make up about 10 to 15 percent of the unit.

The Rockfield soil has a high available water capacity. Permeability is moderate in the upper part of the subsoil and moderately slow in the lower part of the subsoil, which formed in till, and in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow. The water table is within 2.5 to 4.0 feet of the surface during the winter and early spring.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture, and a few are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a problem. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is moderately limited as a site for dwellings with basements because of the wetness and the shrink-swell potential. A drainage system helps to

lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the moderately slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability. Installing perimeter drains around the absorption field helps to lower the water table.

The land capability classification is I. The woodland ordination symbol is 8A.

RrB2—Rockfield-Williamstown complex, 1 to 6 percent slopes, eroded. These gently sloping, deep, moderately well drained soils are on rises on till plains. The Williamstown soil is in the more sloping areas. Areas are irregular in shape and are 5 to more than 15 acres in size. They are about 65 percent Rockfield soil and 20 percent Williamstown soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Rockfield soil is brown silt loam about 9 inches thick. The subsoil is about 48 inches thick. In sequence downward, it is dark yellowish brown, firm silty clay loam; dark yellowish brown, mottled, firm silty clay loam; dark brown, mottled, firm clay loam and sandy clay loam; brown, mottled, friable sandy loam; and dark yellowish brown and brown, mottled, firm clay loam and loam. The underlying material to a depth of 65 inches is yellowish brown loam. In some places the surface layer has more clay. In other places the soil has less clay in the subsoil, the underlying material, or both. In some areas, the glacial till is at a depth of more than 60 inches and the underlying material is loamy and sandy glacial outwash. In other areas the upper part of the subsoil is mottled. In places the slope is less than 1 or more than 6 percent.

In a typical profile, the surface layer of the Williamstown soil is brown loam about 9 inches thick. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, firm clay loam; the next part is dark yellowish brown, mottled, firm clay loam; and the lower part is dark yellowish brown, mottled, friable loam. The underlying material to a depth of 60 inches is dark yellowish brown and yellowish brown loam. In some places the surface layer has more clay. In other places the soil has less clay in the subsoil, the underlying material, or both. In some areas loamy or sandy glacial outwash is directly above the underlying material. In other areas the subsoil does not have mottles. In places the slope is less than 1 or more than 6 percent.

Included with these soils in mapping are areas of the somewhat poorly drained Fincastle soils on slight rises. Included soils make up about 15 percent of the unit.

The Rockfield soil has a high available water capacity. The Williamstown soil has a moderate available water capacity. Permeability is moderate in the upper part of the subsoil in the Rockfield soil and moderately slow in the lower part of the subsoil, which formed in till, and in the underlying material. It is moderate in the subsoil of the Williamstown soil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer of both soils. Runoff is medium. During the winter and early spring, the water table is at a depth of 2.5 to 4.0 feet in the Rockfield soil and 1.5 to 3.5 feet in the Williamstown soil.

Most areas of these soils are used for cultivated crops. A few are used for hay, pasture, or woodland.

These soils are well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. Erosion can be minimized by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface helps to maintain soil structure, tilth, soil aeration, the organic matter content, and the infiltration rate and helps to prevent crusting after heavy rainfall. The soils are well suited to no-till and ridge-till cropping systems.

These soils are well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion and runoff are the main hazards. Overgrazing

reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate on the Williamstown soil. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness and the shrink-swell potential, the Rockfield soil is moderately limited as a site for dwellings. Because of the wetness and the shrink-swell potential, the Williamstown soil is moderately limited as a site for dwellings without basements and severely limited as a site for dwellings with basements. Constructing the buildings on raised, well compacted fill material can increase the depth to the water table. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material helps to prevent the structural damage caused by shrinking and swelling. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of low strength and frost action, these soils are severely limited as sites for local roads and streets. Strengthening or replacing the base material with a better suited material improves the ability of the roads and streets to support vehicular traffic. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action.

Because of the moderately slow permeability, these soils are severely limited as sites for septic tank absorption fields. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability.

The land capability classification is IIe. The woodland ordination symbol assigned to the Rockfield soil is 8A, and the one assigned to the Williamstown soil is 5A.

Rt—Ross fine sandy loam, protected. This nearly level, deep, well drained soil is on flood plains. It is protected from flooding by levees. Areas are irregular in shape and are 20 to more than 200 acres in size.

In a typical profile, the surface soil is very dark grayish brown fine sandy loam about 28 inches thick. The subsoil is 40 inches thick. It is dark brown, friable fine sandy loam in the upper part; brown, friable fine sandy loam in the next part; and dark yellowish brown, friable very fine sandy loam in the lower part. The underlying material to a depth of 80 inches is brown very fine sandy loam. In some places the surface layer and subsoil have less sand and more silt. In other places the dark surface layer is less than 24 inches thick. In a few places the soil has less clay in the surface layer, the subsoil, or both. In some areas the underlying material has less clay. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained and moderately well drained soils in the lower positions on the landscape. Included soils make up about 10 to 15 percent of the unit.

The Ross soil has a high available water capacity. Permeability is moderate. Organic matter content is high in the surface layer. Runoff is slow.

All areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting

mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the potential for flooding as a result of levee failure, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is moderately limited as a site for local roads and streets because of low strength and frost action. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic.

The land capability classification is I. The woodland ordination symbol is 5A.

Ru—Ross loam, rarely flooded. This nearly level, deep, well drained soil is on flood plains. During the winter and spring, it is subject to rare flooding of brief duration. Areas are irregular in shape and are 20 to more than 80 acres in size.

In a typical profile, the surface soil is very dark grayish brown loam about 16 inches thick. The subsoil is 64 inches thick. In sequence downward, it is very dark grayish brown, friable loam; dark brown and brown, friable loam; dark yellowish brown, friable sandy loam; and dark brown, firm gravelly clay loam. In some places the surface layer and subsoil have less sand and more silt. In other places the dark surface layer is less than 24 inches thick. In a few places the soil has less clay in the surface layer, the subsoil, or both. In some areas very gravelly coarse sand is within a depth of 80 inches. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained and moderately well drained soils in the lower positions on the landscape. They make up about 10 to 15 percent of the unit.

The Ross soil has a high available water capacity. Permeability is moderate. Organic matter content is high in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a problem. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, low strength, and frost action. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action, reduce the wetness, and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets also reduces the wetness and the potential for frost action.

The land capability classification is I. The woodland ordination symbol is 5A.

RwA—Rush silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on terraces. Areas are elongated and are parallel to streams. They are 5 to more than 100 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 47 inches thick. In sequence downward, it is dark yellowish brown, firm silty clay loam; brown, firm clay loam and gravelly clay loam; dark brown, firm gravelly sandy clay loam and gravelly clay loam; and dark brown, friable gravelly sandy loam. The underlying material to a depth of 65 inches is brown very gravelly coarse sand. In some areas the surface layer is gravelly. In other areas the subsoil has less clay. In some places calcareous glacial till is within a depth of 60 inches. In other places

the slope is more than 2 percent. Some areas are not a source of sand and gravel. In a few places the thickness of the silty material is as much as 60 inches. In some areas the lower part of the subsoil has less than 15 percent gravel. In a few other areas mottles are below a depth of 30 inches. In places the silty material is less than 24 inches thick.

Included with this soil in mapping are the well drained Ockley soils. These soils formed in a thinner deposit of silty material than the Rush soil. Also, they are more sloping. Also included are the somewhat poorly drained Waynetown soils on the lower rises. Included soils make up about 5 to 15 percent of the unit.

The Rush soil has a high available water capacity. Permeability is moderate in the subsoil and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a problem. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Seedlings can survive and grow well, however, if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

This soil is suitable as a site for septic tank absorption fields.

The land capability classification is I. The woodland ordination symbol is 5A.

Sn—Sloan silt loam, rarely flooded. This nearly level, deep, very poorly drained soil is on flood plains. During the winter and early spring, it is subject to rare flooding of brief duration. Areas are elongated and are parallel to streams. They are dominantly about 5 to more than 40 acres in size.

In a typical profile, the surface soil is very dark gray silt loam about 12 inches thick. The subsoil is about 25 inches thick. It is dark gray and gray, mottled, friable loam. The upper part of the underlying material is gray, mottled loam. The lower part to a depth of 70 inches is gray, mottled loam stratified with silt loam and fine sandy loam. Small areas are subject to flooding of long duration. In some areas the dark surface layer is less than 10 inches thick. In other areas the surface layer is lighter colored depositional material. In some places the soil has less clay or more clay in the surface layer, the subsoil, the underlying material, or all three. In other places the surface layer is a thin layer of mucky silt loam or muck. In some areas bedrock is within a depth of 60 inches. In other areas calcareous glacial till is within a depth of 60 inches. Some areas are underlain by calcareous sand and gravelly sand. In places the surface layer, subsoil, and underlying material have less sand and more silt.

Included with this soil in mapping are areas of somewhat poorly drained soils on slight rises. Also included are small areas that are subject to occasional flooding of brief duration and some areas that have not been drained and remain wet most of the year. Included soils make up about 6 to 10 percent of the unit.

The Sloan soil has a high available water capacity. Permeability is moderate. Organic matter content is

high in the surface layer. Runoff is very slow. The water table is at or near the surface from late fall through spring.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is fairly well suited to corn and soybeans. Crusting is a problem. Wetness and a cold soil temperature are limitations. The wetness hinders normal root growth, resulting in a shallow root zone. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. If drained, this soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. It is better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. Flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can also be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the wetness and low strength. Maintaining a crown on roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. A coarse textured subgrade and base material helps to prevent the damage caused by low strength.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

So—Sloan silt loam, occasionally flooded. This nearly level, deep, very poorly drained soil is on flood plains. From late fall to spring, it is subject to occasional flooding of brief duration. Areas are elongated and are 10 to more than 80 acres in size.

In a typical profile, the surface soil is very dark grayish brown silt loam about 14 inches thick. The subsoil is dark gray, mottled, firm loam about 24 inches thick. The upper part of the underlying material is dark grayish brown, mottled sandy loam. The next part is dark grayish brown, mottled gravelly sandy loam. The lower part to a depth of 60 inches is dark grayish brown, mottled loam and sandy loam. In some areas the dark surface layer is less than 10 inches thick, and in other areas the surface layer is lighter colored depositional material. In some places the soil has less clay or more clay in the surface layer, the subsoil, the underlying material, or all three. In other places the surface layer is a thin layer of mucky silt loam or muck. In some areas bedrock is within a depth of 60 inches. In other areas calcareous glacial till is within a depth of 60 inches. Some areas are underlain by calcareous sand and gravelly sand. In other areas the surface layer, subsoil, and underlying material have less sand and more silt.

Included with this soil in mapping are areas of somewhat poorly drained soils on slight rises. Also included are areas that are frequently flooded for brief periods and some areas that have not been drained and remain wet most of the year. Included soils make

up about 8 to 15 percent of the unit.

The Sloan soil has a high available water capacity. Permeability is moderate. Organic matter content is high in the surface layer. Runoff is very slow. The water table is at or near the surface from late fall through spring.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is fairly well suited to corn and soybeans. Flooding is a hazard, and wetness and a cold soil temperature are limitations. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by floodwater during the winter and early spring even if a drainage system has been established for row crops. Late planting or replanting is sometimes necessary because of the flooding. The wetness hinders normal root growth, resulting in a shallow root zone. Levees help to control flooding. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. If drained, the soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. It is better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. Flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, the wetness, and low strength. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts reduce the wetness and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets reduces the wetness.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Ss—Sloan silt loam, bedrock substratum, occasionally flooded. This nearly level, deep, very poorly drained soil is on flood plains. During the winter and early spring, it is subject to occasional flooding of brief duration. Areas are elongated and are more than 200 acres in size.

In a typical profile, the surface layer is very dark gray silt loam about 15 inches thick. The subsoil is dark gray and gray, mottled, friable loam about 21 inches thick. The underlying material is gray, mottled loam to a depth of 48 inches. It is underlain by limestone bedrock. In some areas the dark surface layer is less than 10 inches thick. In other areas the surface layer is lighter colored depositional material. In some places the soil has more clay in the surface layer, the subsoil, the underlying material, or all three. In other places calcareous glacial till is within a depth of 60 inches.

Some areas are underlain by calcareous sand and gravelly sand. In other areas the surface layer, the subsoil, or the underlying material has less clay or has less sand and more silt. In places the surface layer is mucky silt loam or muck.

Included with this soil in mapping are areas of somewhat poorly drained soils on slight rises. Also included are areas that are frequently flooded for brief periods and some areas that have not been drained and remain wet most of the year. Included soils make up about 5 to 10 percent of the unit.

The Sloan soil has a high available water capacity. Permeability is moderate. Organic matter content is high in the surface layer. Runoff is very slow. The water table is at or above the surface from late fall through spring.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is fairly well suited to corn and soybeans. Flooding is a hazard. Wetness and a cold soil temperature are limitations. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by floodwater during the winter and early spring even if a drainage system has been established. Late planting or replanting is sometimes necessary because of the flooding. The wetness hinders normal root growth, resulting in a shallow root zone. Levees help to control flooding. In some areas no drainage outlet is available. If an outlet is available, excess water can be removed by surface drains, subsurface drains, pumps, or a combination of these. Small, enclosed depressions can be drained by a combination of an open inlet pipe and subsurface drains. If drained, the soil warms up earlier in the spring. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. It is better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. The flooding and frost heaving are hazards. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary flooding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the flooding and the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, the ponding, and low strength. Levees help to control flooding. Constructing the roads on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts reduce the wetness and improve the ability of the roads to support vehicular traffic. Conveying runoff to suitable outlets also reduces the wetness.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

StA—Starks silt loam, 0 to 1 percent slopes. This nearly level, deep, somewhat poorly drained soil is on slight rises on outwash plains. Areas are irregular in shape and are 3 to more than 100 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 54 inches thick. It is mottled. The upper part is grayish brown and dark yellowish brown, firm silty clay loam;

the next part is dark yellowish brown, friable silt loam; and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 80 inches is brown, mottled loam stratified with sandy loam and loamy sand. In a few places the solum is less than 40 inches thick. In some places the lower part of the solum developed in glacial till. In other places the silty material is at a depth of more than 40 inches. In a few areas the subsoil has more sand and less silt. In other areas it has less clay. In some places the lower part of the subsoil has as much as 20 percent gravel. In other places the silty material is less than 24 inches thick. In some areas the slope is more than 1 percent.

Included with this soil in mapping are the well drained Camden soils and the moderately well drained Rockfield soils on slight rises and knolls, the poorly drained Cyclone and Patton soils in narrow depressions, the somewhat poorly drained Fincastle soils in the slightly higher areas, and the moderately well drained Williamstown soils along drainageways and on knolls. Fincastle soils are not stratified and are underlain by calcareous glacial till. Included soils make up about 10 to 15 percent of the unit.

The Starks soil has a high available water capacity. Permeability is moderate. Organic matter content is moderately low in the surface layer. Runoff is slow. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or both. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-chisel and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. It is better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. Frost heaving is a hazard. The wetness is a limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, this soil is severely limited as a site for dwellings. A drainage system can lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing perimeter drains around the absorption field can lower the water table.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Ud—Udorthents, loamy. These nearly level to strongly sloping, shallow to deep, well drained to somewhat poorly drained soils are in disturbed areas on till plains, moraines, terraces, outwash plains, and flood plains. They are near gravel pits, limestone quarries, sanitary landfills, lake cottages along Lake Freeman, and factories and in agricultural areas. In some places, deep cuts have been made in the original land surface and the removed soil material has been used as fill in the lower areas. Adding fill in these areas has resulted in a smoother, more level surface. In other places the soil material was removed for use as fill on highway grades. Some borrow areas have filled with water and are used as recreational areas or for various types of

wildlife habitat. Areas are irregular in shape and are 3 to more than 50 acres in size.

In a typical unit, the soil material is a mixture of the surface soil, subsoil, and underlying material of the original soils. It is loamy, sandy, or silty. In some areas it has some sand, gravel, siltstone, limestone, dolomite, shale, cobbles, or stones. The soil is slightly acid to moderately alkaline. In areas where a deep cut has been made, the material is mainly calcareous glacial till.

Included with these soils in mapping are small areas where slopes are short and steep; areas of sand and gravel; areas where bedrock is exposed; some areas that are wet during part or all of the year; and areas where the soil material was removed for use as fill or to form levees. Also included are some areas along the major drainageways that are subject to occasional flooding. Highways and other public works and buildings cover some areas. Included areas make up about 10 to 15 percent of the unit.

The Udorthents have a moderate available water capacity. Permeability is moderate to slow. Organic matter content is very low in the surface layer. The surface layer is firm, and tilth is poor. Runoff is slow to rapid. The areas are difficult to reclaim. Revegetation and erosion control are extremely difficult, especially in the more sloping areas.

Most areas are idle and support a permanent cover of grasses and weeds or low-growing shrubs. Access to these areas is limited. Special management is needed in all areas. An intensified fertility program with special emphasis on the use of organic material or manure is needed if cultivated crops are grown. Conservation practices that control erosion are needed in the gently sloping and moderately sloping areas. Examples are diversions, box inlet structures, grade stabilization structures, and grassed waterways.

The suitability of these soils for crops, pasture, woodland, building site development, and recreational uses varies greatly. Onsite investigation is needed to determine the practices that are necessary to overcome hazards and limitations and to address specific management concerns. The depth to the water table, the slope, and the shrink-swell potential should be considered. Because the soil material varies, engineering tests are needed. The soil properties that are significant in the design of a structure vary from one location to another and within a unit. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible and by establishing a protective plant cover as soon as possible after construction is completed. Drainage is needed in some nearly level areas. The wetness and permeability in the nearly level areas and the slope and permeability in the gently sloping to moderately sloping areas can adversely affect areas used as sites for septic tank absorption fields.

No land capability classification or woodland ordination symbol is assigned.

Wd—Wallkill silt loam. This nearly level, deep, very poorly drained soil is in potholes on outwash plains, terraces, moraines, and till plains. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are mostly oval, but a few are irregular in shape. They are 2 to 25 acres in size.

In a typical profile, the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is very dark gray and dark gray, mottled silt loam about 19 inches thick. The underlying material to a depth of 60 inches is black muck. In some places coprogenous earth is below the mineral overwash. In a few other places the mineral material overlying the organic material is loam or sandy loam. In some areas more than 40 inches of mineral overwash overlies the muck. In a few places the surface layer is mucky silt loam or muck.

Included with this soil in mapping are the very poorly drained Milford soils. These soils are in positions on the landscape similar to those of the Wallkill soil, but they have more clay in the control section and less muck in the underlying material. Also included are the very poorly drained Houghton and Palms soils in the lower areas. They have more muck in the surface layer than the Wallkill soil. Included soils make up about 10 to 15 percent of the unit.

The Wallkill soil has a very high available water capacity. Permeability is moderate in the mineral material and moderately rapid or rapid in the organic material. Organic matter content is moderate in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface during the winter and early spring.

Most areas of this soil are drained and used for cultivated crops. Some are used for pasture or woodland. Undrained areas provide habitat for wetland wildlife.

If drained, this soil is fairly well suited to corn and soybeans. Wetness is the main limitation, and ponding is a hazard. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established for row crops. The wetness and the ponding can hinder the use of farm equipment. Open ditches, subsurface drains and outlets, pumps, or a combination of these can remove

excess water. Surface inlet risers are often needed. Overdrainage can result in accelerated subsidence of the muck. Raising the water table during fallow periods slows the rate of subsidence. Diverting runoff from the higher surrounding land reduces ponding and enhances the drainage system efficiency. A system of conservation tillage that leaves protective amounts of crop residue on the surface helps to prevent crusting, maintain organic matter content, and increase the infiltration rate. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. It is better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. The wetness is the main limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is poorly suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding and frost action. Maintaining a crown on roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the ponding. Coarse textured subgrade or base material helps to prevent the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 3W.

We—Warners Variant silt loam, 2 to 8 percent slopes, undrained. This gently sloping, deep, very poorly drained soil is on foot slopes below terraces and outwash plains. It is frequently charged with calcium carbonate-rich water from seepage areas at the bottom of very steep slopes and by surface runoff from the higher adjacent areas. Areas are elongated and are 5 to 15 acres in size.

In a typical profile, the surface layer is black silt loam about 8 inches thick. The upper part of the underlying material is very dark gray silt loam; the next part is dark grayish brown, mottled silt loam; and the lower part to a depth of 60 inches is grayish brown, mottled marl. In some places the upper part of the underlying material has more clay. In other places as much as 12 inches of organic material is on the surface. In some areas the slope is less than 2 or more than 8 percent. In other areas the surface soil and underlying material are gravelly sandy loam or loam.

Included with this soil in mapping are the well drained Piankeshaw Variant soils in the higher areas. Also included are some areas of soils that are drained. Included soils make up about 5 to 15 percent of the unit.

The Warners Variant soil has a moderate available water capacity. Permeability is moderately slow. Organic matter content is high in the surface layer. Runoff is slow. The water table is at or near the surface from fall through late spring.

Most areas of this soil are undrained and are in pasture or woodland. A few are used for cultivated crops or as habitat for wetland wildlife. This soil is generally unsuited to corn, soybeans, and small grain because of wetness.

This soil is poorly suited to grasses, such as reed canarygrass and ladino clover, for pasture. It is generally unsuited to hay crops. The wetness is the main limitation. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields.

Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

Because of the wetness, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the wetness and frost action. Maintaining a crown on the roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. Coarse textured subgrade or base material helps to prevent the damage caused by frost action.

The land capability classification is Vw. No woodland ordination symbol is assigned.

Wk—Washtenaw silt loam. This nearly level, deep, poorly drained soil is along the edges of depressions and in drainageways on outwash plains, till plains, and moraines. It is frequently ponded by surface runoff from the higher adjacent areas. Areas are irregular in shape and are 5 to more than 20 acres in size.

In a typical profile, the surface soil is dark brown silt loam about 13 inches thick. The next layer to a depth of 27 inches is dark grayish brown and dark gray silt loam. The buried surface layer is very dark gray, firm silty clay loam about 9 inches thick. The buried subsoil is about 44 inches thick. It is dark grayish brown and grayish brown, mottled, firm silty clay loam in the upper part and grayish brown, mottled, firm clay loam and loam in the lower part. In a few areas the surface layer is sandy loam. In places strata of sand, sandy loam, and silt loam are at a depth of 50 to 80 inches. In some areas the overwash is only 10 inches thick. On some toe slopes, this soil is subject to rare flooding. Some areas are underlain by calcareous sand and gravelly sand. In places the overwash is more than 40 inches thick. In some areas the soil does not have mottles below the surface layer. In other areas the slope is more than 2 percent. In some places the surface layer has more clay. In other places calcareous, firm glacial till is within a depth of 80 inches.

Included with this soil in mapping are the well drained Martinsville soils in the higher areas. Also included are the poorly drained Cyclone soils in the slightly higher areas. Cyclone soils have a darker surface layer than that of the Washtenaw soil. Some areas have not been drained and remain wet most of the year. Included soils make up about 5 to 15 percent of the unit.

The Washtenaw soil has a high available water capacity. Permeability is moderate in the alluvium and slow in the lower part of the profile. Organic matter content is moderate in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface during the winter and spring.

Most areas of this soil are drained and used for cultivated crops. Some are used for hay, pasture, wildlife habitat, or woodland.

If drained, this soil is well suited to corn and soybeans. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. Small grain that is seeded in fall or early spring may be damaged by ponding during the winter and early spring even if a drainage system has been established for row crops. The wetness and the ponding can hinder the use of farm equipment. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Surface inlet pipes are often needed. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. Even if subsurface and shallow surface drains are installed, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling

mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stands may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding and frost action. Maintaining a crown on the roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by ponding. Coarse textured subgrade or base material helps to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

WoA—Waynetown silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on slight rises on terraces. Areas are irregular in shape or elongated and are 3 to more than 50 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 45 inches thick. It is mottled. In sequence downward, it is dark yellowish brown, firm silty clay loam; dark yellowish brown, firm clay loam and gravelly sandy clay loam; brown, firm gravelly sandy clay loam; and brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches is grayish brown very gravelly loamy coarse sand. Some areas are not a source of sand and gravel. In some places the silty material is more than 40 inches thick. In a few places the lower part of the subsoil has thin layers of loamy sand or sand. In other places calcareous glacial till is within a depth of 60 inches. In a few areas the subsoil has more sand and less clay or has less clay. In other areas the surface layer has less clay. In places the slope is more than 2 percent.

Included with this soil in mapping are the very poorly drained Mahalasville soils in depressions, the well drained Ockley and Rush soils on the higher rises, and the somewhat poorly drained Sleeth soils in the slightly higher areas. Mahalasville soils are those that have a gravelly substratum. Sleeth soils formed in a thinner deposit of silty material than the Waynetown soil. Included soils make up about 10 to 15 percent of the unit.

The Waynetown soil has a high available water capacity. Permeability is moderate in the subsoil and very rapid in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is slow. The water table is at a depth of 1 to 3 feet in winter and early spring.

Most areas of this soil are drained and used for cultivated crops. Some are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or both. Open ditches are needed in some places for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain good soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-chisel and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. It is better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted legumes. The wetness is a limitation. Frost heaving is a hazard. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting

mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, this soil is severely limited as a site for dwellings. A drainage system helps to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing perimeter drains around the absorption field helps to lower the water table.

The land capability classification is IIw. The woodland ordination symbol is 5A.

WpA—Waynetown-Sleeth silt loams, till substrata, 0 to 1 percent slopes. These nearly level, deep, somewhat poorly drained soils are on slight rises on outwash plains. The Waynetown soil is in the lower areas. Areas are irregular in shape and are 3 to more than 100 acres in size. They are about 50 percent Waynetown soil and 40 percent Sleeth soil. Both soils have a till substratum. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the surface layer of the Waynetown soil is dark grayish brown silt loam about 10 inches thick. The subsoil is about 48 inches thick. In sequence downward, it is brown and dark yellowish brown, mottled, firm silty clay loam; dark yellowish brown, mottled, friable very fine sandy loam and fine sandy loam; dark grayish brown, firm gravelly clay loam; and very dark grayish brown, firm gravelly loam. The underlying material to a depth of 60 inches is brown loam. In some places gravelly coarse sand, silt loam, sand, and fine sand are above the firm glacial till. In a few places the firm glacial till is within a depth of 40 inches. In other places firm glacial till is below a depth of 60 inches. In some areas a 3- to 10-inch subsoil layer has formed in the glacial till. In a few areas the upper part of the subsoil is not mottled. In other areas the slope is more than 1 percent.

In a typical profile, the surface layer of the Sleeth soil is dark brown silt loam about 8 inches thick. The subsoil is about 40 inches thick. It is mottled. The upper part is brown and dark yellowish brown, firm silty clay loam; the next part is brown and dark yellowish brown, firm clay loam; and the lower part is dark grayish brown, firm gravelly sandy clay loam. The upper part of the underlying material is grayish brown very gravelly loamy coarse sand. The lower part to a depth of 60 inches is yellowish brown loam. In some places coarse sand, silt loam, sand, and fine sand are above the firm glacial till. In a few places the glacial till is within a depth of 40 inches. In other places a 3- to 10-inch subsoil layer has formed in the glacial till. In some areas firm glacial till is below a depth of 60 inches. In other areas the slope is more than 1 percent.

Included with these soils in mapping are areas of the very poorly drained Mahalasville soils in depressions and the well drained Ockley and Rush soils on slight rises. All of these included soils have a till substratum. They make up about 10 percent of the unit.

The Waynetown and the Sleeth soils have a high available water capacity. Permeability is moderate in the subsoil of the Waynetown soil and moderately slow in the underlying glacial till. It is moderate in the subsoil of the Sleeth soil, very rapid in the upper part of the underlying material, and moderately slow in the lower part. Organic matter content is moderately low in the surface layer of both soils. Runoff is slow. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of these soils are drained and used for cultivated crops. Some are used for pasture, hay, or woodland.

If drained, these soils are well suited to corn, soybeans, and small grain. Wetness is a limitation. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or both. In some places open ditches are needed for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soils are well suited to fall-chisel and ridge-till cropping systems.

If drained, these soils are well suited to grasses and legumes, such as orchardgrass and ladino clover, for hay or pasture. They are better suited to deep-rooted legumes, such as alfalfa, than to shallow-rooted

legumes. The wetness is a limitation. Frost heaving is a hazard. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

These soils are well suited to trees. Plant competition is severe. Seedlings can survive and grow well, however, if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness, these soils are severely limited as sites for dwellings. Subsurface drains help to lower the water table. Constructing the buildings on raised, well compacted fill material increases the depth to the water table. The dwellings should be constructed without basements.

Because of low strength and frost action, these soils are severely limited as sites for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action. Strengthening or replacing the base material with a more suitable material improves the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the moderately slow permeability and the wetness, these soils are severely limited as sites for septic tank absorption fields. Enlarging the absorption field or using a holding tank minimizes the adverse effects of the moderately slow permeability. Installing perimeter drains around the absorption field helps to lower the water table.

The land capability classification is IIw. The woodland ordination symbol is 5A.

Wr—Westland loam. This nearly level, deep, very poorly drained soil is in depressions on terraces. It is frequently ponded by runoff from the higher adjacent areas. Areas are mostly irregular in shape, but many are elongated. They are 5 to more than 50 acres in size.

In a typical profile, the surface layer is very dark gray loam about 10 inches thick. The subsurface layer is about 6 inches of very dark gray clay loam. The subsoil is about 35 inches thick. The upper part is dark gray and dark grayish brown, mottled, firm clay loam, and the lower part is grayish brown, mottled, firm clay loam and gravelly sandy clay loam. The underlying material to a depth of 60 inches is grayish brown very gravelly coarse sand. In some areas the dark surface layer is less than 10 inches thick. In other areas, the subsoil is thicker and the depth to loose sand and gravel is more than 60 inches. Some areas are not a source of sand and gravel. In some places the surface layer is lighter colored depositional material. In other places the silty material is as much as 24 inches thick. In some areas calcareous glacial till is within a depth of 60 inches. In a few places the subsoil has more sand and less clay. In some areas the surface layer is mucky loam or muck or is clay loam or silty clay loam. In other areas the surface layer and the upper part of the subsoil have more than 15 percent gravel.

Included with this soil in mapping are small areas of the well drained Mudlavia and Ockley soils on slight rises. Included soils make up about 10 to 15 percent of the unit.

The Westland soil has a high available water capacity. Permeability is moderate in the subsoil and very rapid in the underlying material. Organic matter content is high in the surface layer. Runoff is very slow or ponded. The water table is at or above the surface during the winter and early spring.

Most areas of this soil are drained and used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or both. In some places open ditches are needed for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The

ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding and frost action. Maintaining a crown on the roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the wetness. Coarse textured subgrade or base material helps to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Ws—Westland loam, shale substratum. This nearly level, deep, very poorly drained soil is in depressions on terraces. It is frequently ponded by runoff from the higher adjacent areas. Areas are mostly irregular in shape, but many are elongated. They are 5 to more than 40 acres in size.

In a typical profile, the surface soil is very dark gray loam about 13 inches thick. The subsoil is about 39 inches thick. The upper part is dark grayish brown and brownish gray, mottled, firm clay loam, and the lower part is grayish brown, mottled, friable gravelly loam and gravelly sandy loam. The underlying material to a depth of 58 inches is grayish brown very gravelly sandy loam. It is underlain by acid shale bedrock. In some areas the dark surface layer is less than 10 inches thick. In other areas, stratified sand and gravel are above the shale and the shale bedrock is at a depth of more than 80 inches. In some places the surface layer is lighter in color. In other places the silty material is as much as 24 inches thick. In a few places the subsoil has more sand and less clay. In some areas the surface layer is mucky loam or muck. In other areas it has more clay. In some places the slope is more than 2 percent. In other places the surface layer and the upper part of the subsoil have more than 15 percent gravel.

Included with this soil in mapping are small areas of somewhat poorly drained soils and the well drained Ockley soils on slight rises. Included soils make up about 10 to 15 percent of the unit.

The Westland soil has a moderate available water capacity. Permeability is moderate. Organic matter content is high in the surface layer. Runoff is ponded or very slow. The water table is at or above the surface during the winter and early spring.

Most areas of this soil are drained and used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is a limitation, and ponding is a hazard. Crusting is a problem. The wetness hinders normal root growth, resulting in a shallow root zone. Excess water can be removed by surface drains, subsurface drains, or a combination of these. In some places open ditches are needed for subsurface drain outlets. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to fall-plow, fall-chisel, and ridge-till cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay or pasture. The wetness is a limitation. The

ponding and frost heaving are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth, reduces forage yields, damages the sod, and reduces plant density and hardiness. A drainage system increases forage yields. Even if subsurface and shallow surface drains are installed, however, legumes can be damaged by the temporary ponding. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer minimize surface compaction, help to maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. The wetness is a limitation. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation can be minimized by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than are necessary can compensate for the seedling mortality rate, but thinning may be required after the trees are established. The seedling mortality rate can be reduced by planting containerized nursery stock. Harvest methods that leave some mature trees in the stand may be desirable because the trees provide shade and protection for seedlings. Seedlings can survive and grow well if competing vegetation is controlled. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of unharvested trees. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Maintaining a crown on the roads, constructing the roads on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts reduce the ponding. Coarse textured subgrade or base material helps to prevent the damage caused by frost action and improves the ability of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 5W.

WvB2—Williamstown silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on side slopes along drainageways on till plains. Areas are irregular in shape and are 3 to more than 45 acres in size.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. It contains about 20 percent dark yellowish brown subsoil material. The subsoil is about 25 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay loam, clay loam, and sandy clay loam, and the lower part is brown, mottled, friable fine sandy loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the surface layer has more clay. In other places the soil has less clay in the subsoil, the underlying material, or both. In some areas the underlying material is glacial outwash. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are the somewhat poorly drained Fincastle and Starks soils in the lower areas and the moderately well drained Rockfield soils on slight rises and knolls. Rockfield soils formed in a thicker deposit of silty material than the Williamstown soil. Also, they are deeper to firm glacial till. Included soils make up about 8 to 15 percent of the unit.

The Williamstown soil has a moderate available water capacity. Permeability is moderate in the subsoil and moderately slow in the underlying material. Organic matter content is moderately low in the surface layer. Runoff is medium. The water table is at a depth of 1.5 to 3.5 feet during the winter and early spring.

Most areas of this soil are used for cultivated crops. Some are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crusting is a problem. The hazard of erosion can be reduced by water- and sediment-control basins, terraces, diversions, a system of conservation tillage that leaves protective amounts of crop residue on the surface, cover crops and green manure crops, grade stabilization structures, or a combination of these. Grassed waterways help to control erosion in the drainageways. A cropping system that includes close-growing crops also helps to control erosion. Working the soil at the correct moisture content minimizes compaction and helps to maintain soil structure. A system of conservation tillage that leaves crop residue on the surface, cover crops, and green manure crops help to maintain soil structure, tilth, the infiltration rate, soil aeration, and the organic matter content and help to prevent crusting after heavy rainfall. The soil is well suited to no-till and ridge-till cropping systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay or pasture. Erosion

and runoff are hazards. Overgrazing reduces plant density and hardiness. Grazing during wet periods causes surface compaction, which results in poor tilth and excessive runoff, reduces forage yields, damages the sod, and reduces plant density and hardiness. A permanent cover of grasses and legumes helps to slow runoff and control erosion. Proper stocking rates, timely deferment of grazing, restricted use during wet periods, and rotation grazing during the summer help to control erosion, minimize surface compaction, maintain good plant density and hardiness, and keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings can survive and grow well if competing vegetation is controlled. Site preparation and the control or removal of unwanted trees and shrubs can be accomplished by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, saving desirable seed trees, and excluding livestock from the wooded areas.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Strengthening foundations, footings, and basement walls and backfilling with coarser textured material help to prevent the structural damage caused by shrinking and swelling. A subsurface drainage system of perimeter interceptor drains can reduce the wetness. Disturbing the existing vegetation as little as possible during construction and revegetating disturbed areas as soon as possible reduce the hazard of erosion.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Constructing the roads and streets on raised, well compacted fill material, strengthening or replacing the base material, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by frost action and improve the ability of the roads and streets to support vehicular traffic. Conveying runoff to suitable outlets reduces the potential for frost action.

Because of the moderately slow permeability and the wetness, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field or using holding tanks minimizes the adverse effects of the moderately slow permeability. A drainage system of perimeter interceptor drains around the absorption field helps to lower the water table.

The land capability classification is IIe. The woodland ordination symbol is 5A.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 208,000 acres in the survey area, or nearly 87 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county. Nearly all of the prime farmland is used for corn or soybeans.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the

back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations or hazards, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations or hazards have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in Carroll County are assigned to various interpretive groups at the end of each map unit description and in some of the tables.

Crops and Pasture

Larry Welborn, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in Carroll County, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

This section provides information about the overall agricultural potential and needed practices in the county for those in the agribusiness sector, including equipment dealers, drainage contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Detailed Soil Map Units." The detailed information given in the description of each soil is useful in planning management systems for individual soil resource units, fields, or farms.

In 1982, about 195,739 acres in the county was used as cropland *(11)*. Of this total, 5,188 acres was used only for pasture or grazing, 187,778 acres was harvested cropland, and 2,773 acres was other cropland, including land used for soil improvement crops, land on which crops have failed, land in cultivated summer fallow, and idle land.

Soil drainage is the major problem on about 67 percent of the cropland and pasture in Carroll County. Most of the poorly drained soils, such as Cyclone and Patton soils, are satisfactorily drained for use in agricultural production; however, a few areas of these soils cannot be economically drained. These soils are in depressional areas, and subsurface drainage to a suitable outlet would have to be deep and extended for great distances.

Unless the somewhat poorly drained soils are

artificially drained, they are so wet that crops are damaged during most years. Fincastle and Starks soils, which make up about 53,650 acres, are in this category.

Fox and Kalamazoo soils have good natural drainage most of the year, but they dry out during the summer. Small areas of wetter soils along drainageways and in swales are commonly included in areas of these soils. Artificial drainage is needed in some of these wetter areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and subsurface drainage is needed in most areas of the poorly drained and very poorly drained soils used for intensive row cropping. Subsurface drains need to be more closely spaced in soils that have slow permeability than in the more permeable soils. Subsurface drainage is slow in Milford soils. Locating adequate outlets for subsurface drainage is difficult in many areas of Milford and Pella soils.

Organic soils oxidize and subside when the pore space is filled with air; therefore, special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required by crops during the growing season and raising it to the surface during the rest of the year minimize the oxidation and subsidence of organic soils, such as Houghton soils.

Information on drainage design for each kind of soil is in the Technical Guide available in local offices of the Soil Conservation Service.

Flooding is a hazard on the flood plains in Carroll County. Ceresco and Landes soils are flooded in most years from winter to early spring. Flooding generally does not occur during the cropping season, but it occasionally causes crop losses.

Soil erosion is the major soil problem on about 19 percent of the cropland and pasture. If the slope is more than 2 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging because productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a moderately fine textured subsoil, such as Miami and Ockley soils, and on soils that have a layer in or below the subsoil that limits the depth of the root zone. Erosion also reduces productivity on soils that tend to be droughty, such as Fox soils. Soil erosion also results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, preparing a good seedbed and tilling are difficult where the original surface layer has been eroded away and the subsoil material is exposed. Such spots are common in areas of the severely eroded Miami soils.

Erosion control practices provide surface cover, reduce runoff, and increase infiltration. Plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soil. On livestock farms, which require pasture and hay, including legume and grass forage crops in the cropping system reduces erosion in sloping areas and also provides nitrogen and improves tilth for the following crop.

Slopes are so short and irregular that contour tillage or terracing generally is not practical on sloping soils in Carroll County. A system of conservation tillage that leaves crop residue on the surface increases infiltration, reduces runoff, and helps to control erosion. Conservation tillage can be used on most of the soils in the county, but it is more difficult to use successfully on soils that are severely eroded or that have a moderately fine textured surface layer, such as Milford soils. No-till corn, which is increasing in acreage, is effective in controlling erosion on sloping soils and can be adapted to most soils in the county. No-till cropping systems are more difficult to practice successfully, however, on the soils that have a moderately fine textured surface layer.

Diversions and parallel tile outlet terraces can shorten the length of the slope and are effective in reducing sheet, rill, and gully erosion. They are most practical on deep, well drained soils that are highly susceptible to erosion. The benefits of terracing include a reduction in soil loss and the associated loss of fertilizer elements; a reduction in sediment problems, such as crop damage and damage to water courses; a reduction in the need for grassed waterways that take productive land out of row crops; and a reduction in the amount of pesticides entering water courses. In some areas Miami and Riddles soils are suitable for parallel tile outlet terraces. Soils that have bedrock at a depth of less than 40 inches and soils that have a clayey subsoil are less suitable for terraces and diversions.

Grassed waterways are needed in many areas of Carroll County on sloping soils, such as Williamstown soils. Grassed waterways are also needed where a large watershed drains across areas of the Fincastle and Starks soils. Subsurface drainage generally is needed beneath the waterways installed in these soils. Subsurface drainage should also be installed beneath the waterways in some areas of the Crosby soils that are along drainageways.

Because of the large number of open ditches in the county, many grade stabilization structures are needed. These structures help to control erosion where surface water drains into an open ditch. They generally are needed in steeply graded open ditches and in some channels in which water moves so rapidly that erosion is a problem on the sides and bottom.

Soil blowing is a hazard in drained areas of Houghton soils. Within only a few hours, it can damage these muck soils if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining plant cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing. Windbreaks of adapted shrubs are also effective on the muck soils. Soil blowing also occurs on dark mineral soils if they are bare of vegetation. Soils that are plowed in the fall are very susceptible to soil blowing the following spring.

Soil fertility is naturally low or moderate in most of the soils on the uplands and terraces. The soils on flood plains, such as Beaucoup and Sloan soils, are neutral or mildly alkaline and are naturally higher in plant nutrients than most upland and terrace soils. The poorly drained soils, such as Cyclone and Patton soils, are in slight depressions and receive runoff from adjacent upland soils. They normally are slightly acid or neutral.

Most upland and terrace soils are naturally strongly acid or medium acid. They generally require applications of ground limestone to raise the pH level for good growth of alfalfa and other crops that grow best on neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. Additions of lime and fertilizer on all soils should be based on soil tests, the needs of the crop, and the expected level of yields. The Cooperative Extension Service can help determine the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Many of the soils used for crops have a silt loam or silty clay loam surface layer that is moderately dark or dark and moderate or high in content of organic matter. Generally, the structure of these soils is moderate to weak and some crust forms on the surface after intense rainfall. In some areas the crust is hard when dry and is impervious to water. Regular additions of crop residue, manure, and other organic material can improve soil structure and minimize crust formation.

Fall plowing generally is not a good practice on the light colored soils that have a silt loam, clay loam, or silty clay loam surface layer because a crust forms during the winter and spring. Many of the soils are nearly as dense and hard at planting time as they were before fall plowing. Also, about 19 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in the fall.

The Milford soils are dark and moderately fine textured, and tilth is a problem because the soils often stay wet until late in the spring. If plowed when wet, these soils tend to be very cloddy when dry, making it difficult to prepare good seedbeds. Fall plowing generally results in good tilth in the spring.

Field crops suited to the soils and climate of Carroll County include corn, soybeans, and winter wheat.

Specialty crops in Carroll County include seed corn, popcorn, and tomatoes. The latest information and suggestions for growing specialty crops can be obtained from local offices of the Soil Conservation Service and the Cooperative Extension Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the

Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Tony Grossman, district forester, Indiana Department of Natural Resources, helped prepare this section.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 8, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where

the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are predicted to reach in 20 years on various soils. The estimates in table 9 are based on

measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

James D. McCall, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining

specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, soybeans, oats, sorghum, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, timothy, bromegrass, bluegrass, redtop clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, ragweed, dock, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are maple, beech, oak, hickory, poplar, wild cherry, black walnut, willow, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are cardinal autumn olive, crabapple, and shrub dogwood.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, waterplantain, arrowhead, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, dove, woodcock, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas (fig. 11). Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, kingfishers, mink, and beaver.

Edge habitat is where one major land use cover ends and another begins. Although it is not rated in the table, it is of prime importance for birds and mammals ranging

Figure 11.—This area of Westland loam is suitable habitat for wetland wildlife.

from the smallest songbird to Indiana's largest big game animal, the white-tailed deer. Most of the plants and animals that inhabit both open land and woodland are also in the edge habitat. Desirable edge habitats are consistently used by 10 times more wildlife than are the centers of large fields of either woodland or cropland. A good example of edge habitat is an area where the outside edge of a thick woodland parallels the outside edge of a no-till field of corn.

Engineering

Max L. Evans, state conservation engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet.

Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding or ponding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding or ponding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding or ponding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a

high water table, flooding or ponding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding or ponding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface drains or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding or ponding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravelly sand or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding or ponding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin

layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding or ponding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of

clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a high water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the

soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters

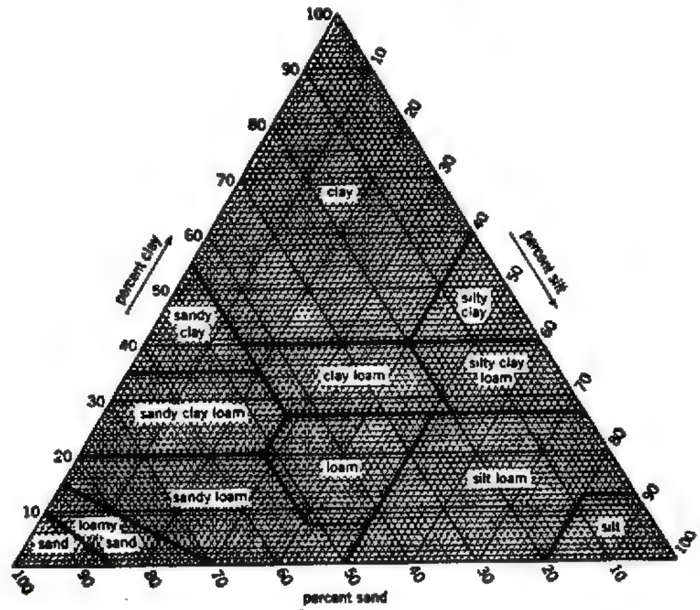


Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

in diameter (fig. 12). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and

clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning

that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in

evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the State Highway Department of Indiana, Division of Materials and Tests.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(9)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (8)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (9)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alvin Series

The Alvin series consists of deep, well drained soils on outwash plains and till plains. These soils formed in wind-deposited sediments. Permeability is moderate in the upper part of the subsoil and moderately rapid in the lower part. Slopes range from 2 to 8 percent.

Alvin soils are commonly near Ockley, Kalamazoo, and Rush soils. Kalamazoo soils have more clay in the upper part of the subsoil than the Alvin soils. Ockley and Rush soils have silty material in the upper part of the solum and have more clay in the subsoil than the Alvin soils. The associated soils are in the lower positions on the landscape.

Typical pedon of Alvin fine sandy loam, 2 to 8 percent slopes, eroded, in a cultivated field; 5,050 feet northeast of the northwest corner and 650 feet southeast of the northwest boundary of the J.W. and H. Connor Reserve, T. 26 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; 20 percent dark yellowish brown (10YR 4/6) sandy loam subsoil material; weak medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; common fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; strongly acid; diffuse wavy boundary.

Bt2—14 to 21 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; diffuse wavy boundary.

Bt3—21 to 26 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; diffuse wavy boundary.

Bt4—26 to 56 inches; dark yellowish brown (10YR 4/6) sandy loam; weak medium subangular blocky structure; friable; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; diffuse wavy boundary.

Bt5—56 to 70 inches; dark yellowish brown (10YR 4/6) loamy sand; weak coarse subangular blocky structure; friable; few fine roots; few discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

E&Bt—70 to 80 inches; yellowish brown (10YR 5/4) sand (E); weak medium granular structure; friable; lamellae of dark yellowish brown (10YR 4/6) loamy sand (Bt); massive; friable; wavy and discontinuous lamellae 1/16 to 1/8 inch thick; neutral.

The solum is more than 80 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is very strongly acid to medium acid. The E&Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is slightly acid or neutral.

Armiesburg Series

The Armiesburg series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Armiesburg soils are similar to Ross soils and are commonly near Jules and Stonelick soils. Ross soils have a thicker surface soil and more sand in the subsoil than the Armiesburg soils. Jules and Stonelick soils do not have a dark surface layer. Jules soils have less clay in the profile than the Armiesburg soils, and Stonelick soils have more sand. Also, Stonelick soils are lower on the landscape.

Typical pedon of Armiesburg silty clay loam, occasionally flooded, in a cultivated field; 7,850 feet west of the southeast corner and 3,500 feet north of the south boundary of the A. Bondle Reserve, T. 25 N., R. 2 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; firm; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A1—9 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; firm; many fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

A2—15 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; few fine roots; mildly alkaline; clear wavy boundary.

Bw1—22 to 34 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; many continuous very

dark grayish brown (10YR 3/2) organic coatings on faces of peds; mildly alkaline; clear wavy boundary.

Bw2—34 to 52 inches; brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; mildly alkaline; clear wavy boundary.

Bw3—52 to 65 inches; brown (10YR 4/3) silty clay loam; weak coarse subangular blocky structure; firm; few fine roots; mildly alkaline; clear wavy boundary.

C—65 to 80 inches; brown (10YR 5/3) silt loam; massive; friable; slight effervescence; mildly alkaline.

The solum is 55 to 70 inches thick. The mollic epipedon is 10 to 22 inches thick. The A horizon has hue of 10YR, value of 3, and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes silt loam. The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Beaucoup Series

The Beaucoup series consists of deep, very poorly drained, moderately slowly permeable soils on narrow flood plains dissecting till plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Beaucoup soils are similar to Sloan soils. Sloan soils have more sand in the subsoil than the Beaucoup soils.

Typical pedon of Beaucoup silty clay loam, rarely flooded, in a cultivated field; 795 feet east and 2,500 feet north of the southwest corner of sec. 18, T. 24 N., R. 1 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; firm; many fine roots; neutral; abrupt smooth boundary.

Bg1—11 to 16 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; neutral; clear wavy boundary.

Bg2—16 to 24 inches; gray (5Y 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; neutral; clear wavy boundary.

Bg3—24 to 30 inches; gray (5Y 5/1) silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg4—30 to 37 inches; gray (5Y 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg5—37 to 42 inches; gray (5Y 5/1) silty clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few fine roots; mildly alkaline; clear wavy boundary.

BCg—42 to 49 inches; gray (5Y 5/1) silty clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Cg1—49 to 54 inches; gray (5Y 5/1) very fine sandy loam; few fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; strong effervescence; moderately alkaline; clear wavy boundary.

Cg2—54 to 58 inches; gray (5Y 5/1) fine sandy loam; few fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; about 1 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

Cg3—58 to 65 inches; gray (5Y 5/1) sandy loam; few fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; about 14 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

The solum is 40 to 60 inches thick. The mollic epipedon is 10 to 18 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam. The Bg horizon has hue of 2.5Y, 5Y, or 10YR, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or silt loam. The Cg horizon has hue of 5Y or 10YR, value of 4 or 5, and chroma of 1 to 3. It is sandy loam, fine sandy loam, very fine sandy loam, or silty clay loam.

Camden Series

The Camden series consists of deep, well drained, moderately permeable soils on outwash plains. These soils formed in silty material and in the underlying glacial outwash. Slopes range from 0 to 6 percent.

Camden soils are commonly near Kendall, Patton, and Starks soils. Kendall and Starks soils are grayer in

the subsoil than the Camden soils. Also, they are lower on the landscape. Patton soils have a darker surface layer than the Camden soils. They are in depressional areas.

Typical pedon of Camden silt loam, 0 to 1 percent slopes, in a cultivated field; 2,335 feet east and 2,470 feet north of the southwest corner of sec. 12, T. 24 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—14 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt3—21 to 27 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt4—27 to 37 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt5—37 to 52 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2Bt6—52 to 65 inches; dark yellowish brown (10YR 4/4) clay loam; weak coarse subangular blocky structure; firm; few fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2C—65 to 80 inches; brown (10YR 5/3) loam; thin strata of silt loam and sandy loam; massive; friable; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 45 to 65 inches thick. The depth to free carbonates is more than 60 inches. The silty material is 24 to 40 inches thick. The Bt horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 4 to 6. It is strongly acid to slightly acid. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 3 to 6. It is clay loam, sandy clay loam, loam, fine sandy loam, or sandy loam. It is medium acid to neutral. The 2C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Casco Series

The Casco series consists of well drained soils that are shallow to sand and very gravelly coarse sand. These soils are on terrace breaks. They formed in loamy sediments over sand and very gravelly coarse sand. Permeability is moderate in the subsoil and very rapid in the underlying material. Slopes range from 30 to 70 percent.

Casco soils are commonly near Hennepin and Rush soils. Hennepin soils formed in glacial till. They are lower on the slope than the Casco soils. Rush soils are deeper to sand and very gravelly coarse sand than the Casco soils. Also, they are higher on the landscape.

Typical pedon of Casco loam, in a wooded area of Casco-Hennepin loams, 30 to 70 percent slopes; 2,250 feet west and 50 feet south of the northeast corner of sec. 30, T. 25 N., R. 1 E.

A—0 to 3 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate coarse granular structure; friable; many fine roots; about 2 percent gravel; neutral; abrupt wavy boundary.

Bt1—3 to 5 inches; brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; medium acid; clear wavy boundary.

Bt2—5 to 10 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 6 percent gravel; medium acid; clear wavy boundary.

2Bt3—10 to 16 inches; dark brown (7.5YR 3/4) gravelly sandy clay loam; moderate coarse subangular blocky structure; firm; common fine roots; thin continuous dark brown (7.5YR 3/2) clay films on faces of peds; about 29 percent gravel; medium acid; clear wavy boundary.

2Bt4—16 to 19 inches; dark reddish brown (5YR 3/4) gravelly sandy clay loam; weak coarse subangular blocky structure; firm; thin continuous dark brown (7.5YR 3/2) clay films on faces of peds; about 23 percent gravel; neutral; abrupt irregular boundary.

2C—19 to 60 inches; brown (10YR 5/3) very gravelly

coarse sand; single grained; loose; about 40 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 24 inches and coincides with the depth to carbonates. The A horizon has hue of 10YR, value of 3 or 4, and chroma of 3. It is dominantly loam, but the range includes sandy loam. The Bt horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 3 or 4. It is clay loam or sandy clay loam. It is medium acid to neutral. The 2Bt horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 4. It is gravelly sandy clay loam or gravelly clay loam. The 2C horizon has 25 to 60 percent coarse fragments.

Ceresco Series

The Ceresco series consists of deep, somewhat poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Ceresco soils are commonly near Cohoctah, Landes, Landes Variant, and Moundhaven soils. Cohoctah soils do not have a dominantly brown horizon below the surface layer. They are in the lower positions on the landscape. Landes and Landes Variant soils are browner in the subsoil than the Ceresco soils. Also, they are higher on the landscape. Moundhaven soils have less clay in the profile and do not have a dark surface layer. They are in the higher positions on the landscape.

Typical pedon of Ceresco fine sandy loam, occasionally flooded, in a cultivated field; 1,200 feet west and 550 feet south of the northeast corner of sec. 35, T. 24 N., R. 1 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bw1—10 to 13 inches; yellowish brown (10YR 5/4) fine sandy loam; many medium distinct gray (10YR 5/1) and common medium faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; many fine roots; neutral; clear wavy boundary.

Bw2—13 to 24 inches; yellowish brown (10YR 5/4) fine sandy loam; many medium distinct gray (10YR 5/1) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw3—24 to 31 inches; brown (10YR 4/3) fine sandy loam; many coarse faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; mildly alkaline; clear wavy boundary.

C1—31 to 35 inches; brown (10YR 5/3) loamy fine sand; many coarse faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; mildly alkaline; clear wavy boundary.

C2—35 to 48 inches; brown (10YR 4/3) fine sandy loam; common medium distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; mildly alkaline; clear wavy boundary.

C3—48 to 60 inches; brown (10YR 5/3) fine sandy loam; strata of loamy fine sand; massive; friable; strong effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is very fine sandy loam, fine sandy loam, loam, or sandy loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. The thickness and texture of the C horizon are variable within short horizontal distances. This horizon is sandy loam, fine sandy loam, silt loam, loam, or loamy fine sand and is stratified.

Ceresco Variant

The Ceresco Variant consists of deep, somewhat poorly drained soils on flood plains. These soils formed in alluvium. Permeability is moderately rapid in the subsoil and the upper part of the underlying material and very rapid in the lower part of the underlying material. Slopes range from 0 to 2 percent.

Ceresco Variant soils are commonly near Cohoctah and Landes soils. Cohoctah soils do not have a dominantly brown horizon below the surface layer. They are in the lower positions on the landscape. Landes soils are browner in the subsoil than the Ceresco soils. Also, they are higher on the landscape.

Typical pedon of Ceresco Variant fine sandy loam, occasionally flooded; in a cultivated field; 100 feet west and 2,300 feet north of the southeast corner of sec. 31, T. 25 N., R. 1 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry;

weak coarse granular structure; friable; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bw—10 to 15 inches; brown (10YR 4/3) fine sandy loam; common medium distinct dark grayish brown (10YR 4/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; many fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bg1—15 to 21 inches; dark grayish brown (10YR 4/2) fine sandy loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; many fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bg2—21 to 29 inches; dark grayish brown (10YR 4/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bg3—29 to 34 inches; dark grayish brown (10YR 4/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bg4—34 to 39 inches; gray (10YR 5/1) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Cg1—39 to 48 inches; gray (10YR 5/1) sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline; clear wavy boundary.

2Cg2—48 to 60 inches; grayish brown (10YR 5/2) very gravelly loamy coarse sand; single grained; loose; about 40 percent gravel; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is fine sandy loam, loam, or sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. The thickness and texture of the Cg horizon are variable within short horizontal distances. This horizon is sandy loam, fine sandy loam, silt loam, loam, or loamy fine sand and is stratified in some pedons. The 2Cg horizon has hue of 10YR, value of 5, and chroma of 2 or 3. It is very gravelly loamy coarse sand or very gravelly coarse sand.

Cohoctah Series

The Cohoctah series consists of deep, very poorly drained soils on flood plains. These soils formed in alluvium. Generally, permeability is moderately rapid. In the gravelly substratum phase, however, it is moderately rapid in the subsoil and the upper part of the underlying material and very rapid in the lower part of the underlying material. Slopes range from 0 to 2 percent.

Cohoctah soils are similar to Sloan soils and are commonly near Ceresco, Ceresco Variant, Landes, Landes Variant, and Moundhaven soils. Sloan soils have more clay in the subsoil and underlying material than the Cohoctah soils. Also, they are further away from the stream. Ceresco and Ceresco Variant soils are less gray in the subsoil than the Cohoctah soils, and Landes, Landes Variant, and Moundhaven soils are browner. These soils are in the higher positions on the landscape. In addition, Moundhaven soils do not have a dark surface layer.

Typical pedon of Cohoctah loam, occasionally flooded, in a cultivated field; 100 feet south and 675 feet west of the northeast corner of sec. 9, T. 24 N., R. 2 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; many fine faint dark gray (10YR 4/1) and few fine distinct dark reddish brown (5YR 3/4) mottles; weak coarse granular structure; friable; many fine roots; neutral; clear wavy boundary.

Bg1—15 to 21 inches; dark grayish brown (2.5Y 4/2) loam; many fine faint dark gray (10YR 4/1) and common medium prominent dark reddish brown (5YR 3/4) mottles; weak fine subangular blocky structure; friable; common fine roots; mildly alkaline; clear wavy boundary.

Bg2—21 to 30 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; common medium prominent dark reddish brown (5YR 3/4) mottles; weak fine subangular blocky structure; friable; common fine roots; mildly alkaline; clear wavy boundary.

Bg3—30 to 39 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; many medium prominent dark reddish brown (5YR 3/4) mottles; weak medium subangular blocky structure; friable; few fine roots; mildly alkaline; clear wavy boundary.

Cg1—39 to 46 inches; dark grayish brown (2.5Y 4/2) sandy loam; thin strata of loamy sand; many fine prominent dark reddish brown (5YR 3/4) mottles; massive; friable; mildly alkaline; clear wavy boundary.

Cg2—46 to 55 inches; very dark grayish brown (2.5Y 3/2) fine sandy loam; common medium prominent dark reddish brown (5YR 3/4) mottles; massive; friable; mildly alkaline; clear wavy boundary.

Cg3—55 to 61 inches; very dark grayish brown (2.5Y 3/2) sandy loam; thin strata of loamy sand; few fine prominent dark reddish brown (5YR 3/4) mottles; massive; friable; about 2 percent gravel; mildly alkaline; clear wavy boundary.

Cg4—61 to 70 inches; grayish brown (2.5Y 5/2) loam; thin strata of sandy loam; many fine prominent strong brown (7.5YR 4/6) mottles; about 3 percent gravel; strong effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam and fine sandy loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is loam, fine sandy loam, or sandy loam. It is mildly alkaline or moderately alkaline. The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. A gravelly substratum phase of this series is mapped in the county.

Cohoctah Variant

The Cohoctah Variant consists of deep, very poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Cohoctah Variant soils are commonly near Landes Variant and Moundhaven soils. Landes Variant and Moundhaven soils have a browner subsoil than the Cohoctah Variant. Also, they are higher on the landscape. In addition, Moundhaven soils do not have a dark surface layer.

Typical pedon of Cohoctah Variant very fine sandy loam, frequently flooded, in a cultivated field; 2,130 feet south and 3,710 feet east of the northwest corner of sec. 33, T. 24 N., R. 1 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bg1—10 to 15 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; many fine distinct gray (N 5/0) and many fine prominent yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; common fine roots; thin continuous very dark grayish brown (10YR 3/2) organic coatings on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

Bg2—15 to 25 inches; dark grayish brown (2.5Y 4/2) sandy loam; few fine distinct gray (N 5/0) and few fine prominent yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; thin discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; strong effervescence; moderately alkaline; clear wavy boundary.

Bg3—25 to 32 inches; dark grayish brown (2.5Y 4/2) sandy loam; few fine distinct gray (N 5/0) and few fine prominent yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; friable; few discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; few fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

Cg1—32 to 44 inches; dark grayish brown (2.5Y 4/2) sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline; clear wavy boundary.

Cg2—44 to 52 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence; moderately alkaline; clear wavy boundary.

Cg3—52 to 56 inches; dark grayish brown (2.5Y 4/2) loamy sand; thin strata of sandy loam; single grained; loose; strong effervescence; moderately alkaline; clear wavy boundary.

Cg4—56 to 60 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; massive; friable; strong effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly very fine sandy loam, but the range includes sandy loam and loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5,

and chroma of 1 or 2. It is fine sandy loam, loam, or sandy loam. The Cg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2.

Coloma Series

The Coloma series consists of deep, excessively drained, rapidly permeable soils on terraces. They formed in wind-deposited sediments. Slopes range from 2 to 10 percent.

Coloma soils are commonly near Fox, Mudlavia, and Ormas soils. Fox soils are moderately deep to sand and very gravelly coarse sand. They are in the lower positions on the landscape. Mudlavia and Ormas soils are underlain by gravelly outwash. These soils have a continuous Bt horizon that has more clay than the Bt horizon in the Coloma soils. They are in the lower positions on the landscape.

Typical pedon of Coloma loamy sand, 2 to 10 percent slopes, in a pasture; 5,450 feet west of the southeast corner and 1,100 feet north of the south boundary of A. Bondie Reserve, T. 25 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

E1—9 to 15 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; few fine roots; slightly acid; diffuse wavy boundary.

E2—15 to 42 inches; light yellowish brown (10YR 6/4) loamy sand; single grained; loose; few fine roots; slightly acid; diffuse wavy boundary.

E&Bt1—42 to 60 inches; light yellowish brown (10YR 6/4) loamy sand (E); single grained; loose; lamellae of dark brown (7.5YR 4/4) sandy loam (Bt); massive; friable; wavy and discontinuous lamellae ⅛ to ¼ inch thick, which total about 2 inches in thickness; medium acid; diffuse wavy boundary.

E&Bt2—60 to 80 inches; yellowish brown (10YR 5/6) loamy sand (E); single grained; loose; lamellae of dark brown (7.5YR 4/4) sandy loam (Bt); massive; friable; wavy and discontinuous lamellae ¼ to ½ inch thick, which total about 3 inches in thickness; slightly acid.

The thickness of the solum and the depth to carbonates range to more than 80 inches. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 3. The E horizon has hue of 10YR and value and chroma of 4 to 6. The Bt part of the E&Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

Crosby Series

The Crosby series consists of deep, somewhat poorly drained, slowly permeable soils on terraces and till plains. These soils formed in silty material and in the underlying glacial till. Slopes range from 0 to 3 percent.

Crosby soils are commonly near Cyclone, Fincastle, Martinsville, Miami, and Starks soils. Cyclone soils have a darker surface layer than the Crosby soils and have a gray subsoil. They are in depressions and drainageways. Fincastle and Starks soils formed in more than 22 inches of silt deposits. They are less sloping than the Crosby soils. Martinsville and Miami soils are browner in the subsoil than the Crosby soils. Also, they are higher on the landscape.

Typical pedon of Crosby silt loam, 0 to 2 percent slopes, in a cultivated field; 2,200 feet west and 2,350 feet north of the southeast corner of sec. 20, T. 26 N., R. 2 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; common fine roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.

Btg—9 to 14 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 3 percent gravel; very strongly acid; clear wavy boundary.

2Bt1—14 to 21 inches; brown (10YR 4/3) clay; many medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 7 percent gravel; very strongly acid; clear wavy boundary.

2Bt2—21 to 27 inches; brown (10YR 4/3) clay loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 7 percent gravel; very strongly acid; clear wavy boundary.

2BCt—27 to 32 inches; brown (10YR 4/3) clay loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; few fine roots; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 7 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

2C—32 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 7 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick, and the depth to carbonates is 20 to 35 inches. The silty material is 0 to 18 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2. It is dominantly silt loam, but the range includes loam. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is very strongly acid to neutral. The 2BC horizon has hue of 10YR, value of 4 or 5, and chroma of 3. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

The Crosby soil in map unit CwB averages less clay in the Bt horizon than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soil.

Crosier Series

The Crosier series consists of deep, somewhat poorly drained, moderately slowly permeable soils on till plains. These soils formed in glacial till. Slopes range from 1 to 6 percent.

Crosier soils are commonly near Mahalasville, Miami, Riddles, Treaty, and Whitaker soils. Mahalasville and Treaty soils have a dark surface layer. They are in the lower positions on the landscape. Miami and Riddles soils are browner in the subsoil than the Crosier soils. Also, they are higher on the landscape. Whitaker soils formed in silty material and loamy outwash over glacial till. They are in the lower positions on the landscape.

Typical pedon of Crosier loam, in a cultivated area of Crosier-Whitaker, till substratum, complex, 1 to 3 percent slopes; 3,250 feet south and 100 feet west of the northeast corner of sec. 3, T. 26 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—9 to 17 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—17 to 25 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

C1—25 to 36 inches; brown (10YR 5/3) loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; about 6 percent gravel; strong effervescence; mildly alkaline; clear wavy boundary.

C2—36 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is clay loam or loam. It is medium acid to neutral. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Cyclone Series

The Cyclone series consists of deep, poorly drained soils in depressions on till plains. These soils formed in silty material and in the underlying glacial till. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes are 0 to 1 percent.

The Cyclone soils in this county are taxadjuncts to the series because they do not have an argillic horizon. This difference, however, does not alter the usefulness or behavior of the soils.

Cyclone soils are similar to Patton, Pella, and Treaty soils and are commonly near Fincastle, Kendall, and Starks soils. Patton soils have stratified underlying material. Pella soils have carbonates within a depth of 40 inches. Treaty soils have a thinner deposit of silty material than the Cyclone soils. Fincastle, Kendall, and Starks soils do not have a dark surface layer and are less gray in the subsoil than the Cyclone soils. Also, they are higher on the landscape.

Typical pedon of Cyclone silty clay loam, in a cultivated field; 2,325 feet east and 125 feet north of the southwest corner of sec. 28, T. 24 N., R. 2 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak coarse granular structure; friable; common fine roots; slightly acid; neutral; abrupt smooth boundary.

A—9 to 12 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak coarse granular structure; friable; few fine roots; neutral; clear wavy boundary.

Btg1—12 to 17 inches; dark gray (10YR 4/1) silty clay loam; few fine distinct dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg2—17 to 22 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct dark grayish brown (10YR 4/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg3—22 to 28 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg4—28 to 35 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg5—35 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg6—44 to 55 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; few fine roots; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.

2BCt—55 to 59 inches; brown (10YR 5/3) loam; many medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; few discontinuous grayish brown (10YR 5/2) clay films on faces of peds; about 4 percent gravel; mildly alkaline; clear wavy boundary.

2C1—59 to 68 inches; brown (10YR 5/3) loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; about 4 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—68 to 80 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 4 percent gravel; strong effervescence; moderately alkaline.

The solum is 50 to 75 inches thick. The silty material is 40 to 60 inches thick. The mollic epipedon is 10 to 15 inches thick. The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2.

Fincastle Series

The Fincastle series consists of deep, somewhat poorly drained soils on till plains. These soils formed in silty material and in the underlying glacial till. The subsoil is moderately permeable, and the underlying material is moderately slowly permeable. Slopes range from 0 to 3 percent.

Fincastle soils are commonly near Crosby, Cyclone, Kendall, Miami, Rockfield, Starks, and Williamstown soils. Crosby soils are more sloping than the Fincastle soils. Also, they formed in a thinner deposit of silty material. Cyclone soils have a dark surface layer. They are in the lower positions on the landscape. Kendall soils are lower on the landscape than the Fincastle soils. Also, they formed in thicker deposits of silty material and are stratified in the underlying material. Miami, Rockfield, and Williamstown soils are browner in the subsoil than the Fincastle soils. Also, they are higher on the landscape. Starks soils have stratified underlying material. They are in the same positions on the landscape as the Fincastle soils.

Typical pedon of Fincastle silt loam, in a cultivated area of Fincastle-Starks silt loams, 0 to 1 percent slopes; 1,890 feet east and 2,395 feet north of the southwest corner of sec. 19, T. 24 N., R. 1 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Btg—9 to 14 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown

(10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

Bt1—14 to 23 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (N 2/0) stains and accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt2—23 to 33 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (N 2/0) stains and accumulations of iron and manganese oxide; about 1 percent gravel; medium acid; clear wavy boundary.

2Bt3—33 to 42 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (N 2/0) stains and accumulations of iron and manganese oxide; about 4 percent gravel; neutral; clear wavy boundary.

2BCt—42 to 48 inches; brown (10YR 5/3) loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 4 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

2C—48 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 4 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The silty material is 22 to 40 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam or silt loam. It is strongly acid to slightly acid. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is neutral or mildly alkaline. The 2C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Fox Series

The Fox series consists of well drained soils that are moderately deep to sand and very gravelly coarse sand. These soils are on terraces. They formed in loamy sediments over sand and very gravelly coarse sand. Permeability is moderate in the subsoil and very rapid in the underlying material. Slopes range from 0 to 15 percent.

Fox soils are commonly near Ockley, Coloma, and Ormas soils. Ockley and Ormas soils are deeper to calcareous sand and gravel than the Fox soils, and Coloma soils have more sand in the profile. Also, these soils are higher on the landscape.

Typical pedon of Fox sandy loam, 0 to 2 percent slopes, in a cultivated field; 1,090 feet north and 2,670 feet east of the southwest corner of sec. 16, T. 25 N., R. 3 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common fine roots; about 10 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; brown (7.5YR 4/4) gravelly sandy loam; moderate fine subangular blocky structure; friable; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 20 percent gravel; slightly acid; clear wavy boundary.

Bt2—14 to 22 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 30 percent gravel; medium acid; clear wavy boundary.

Bt3—22 to 31 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 20 percent gravel; medium acid; clear wavy boundary.

Bt4—31 to 35 inches; dark reddish brown (5YR 3/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 20 percent gravel; neutral; clear wavy boundary.

2C—35 to 60 inches; brown (10YR 5/3) very gravelly

coarse sand; single grained; loose; about 45 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches and coincides with the depth to carbonates. The Ap horizon has hue of 10YR, value of 4 or 5 (6 or 7 dry), and chroma of 3. It generally is sandy loam or loam, but in severely eroded areas the range includes gravelly clay loam or gravelly sandy clay loam. The upper part of the Bt horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 3 or 4. The lower part has hue of 5YR or 7.5YR and value and chroma of 3 or 4. This horizon generally is gravelly sandy loam, gravelly clay loam, or gravelly sandy clay loam, but in thin subhorizons in the upper part the range includes clay loam and sandy loam. The Bt horizon is strongly acid to neutral. In the 2C horizon the content of coarse fragments ranges from 10 to 60 percent.

Hennepin Series

The Hennepin series consists of deep, well drained, moderately slowly permeable soils on till plains, terraces, and outwash plains. These soils formed in glacial till. Slopes range from 30 to 90 percent.

Hennepin soils are commonly near Casco and Rush soils. Casco soils are underlain by sand and gravel. They are on the upper part of the slope. Rush soils are less sloping than the Hennepin soils and have less sand in the upper part of the subsoil. They are underlain by sand and gravel.

Typical pedon of Hennepin loam, 30 to 70 percent slopes, in a wooded area; 650 feet north and 1,350 feet west of the southeast corner of sec. 33, T. 24 N., R. 1 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common medium roots; about 7 percent gravel; mildly alkaline; clear wavy boundary.

Bw1—4 to 9 inches; yellowish brown (10YR 5/4) loam; moderate fine subangular blocky structure; friable; common fine roots; about 6 percent gravel; mildly alkaline; clear wavy boundary.

Bw2—9 to 16 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; friable; common fine roots; about 6 percent gravel; slight effervescence; moderately alkaline; clear wavy boundary.

C1—16 to 30 inches; brown (10YR 5/3) loam; massive; firm; about 6 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C2—30 to 60 inches; brown (10YR 5/3) loam; massive; firm; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 10 to 20 inches thick. The depth to carbonates is 0 to 12 inches. The solum is neutral to moderately alkaline. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2. It is dominantly loam, but the range includes silt loam. The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

Houghton Series

The Houghton series consists of deep, very poorly drained, moderately slowly permeable to moderately rapidly permeable soils on till plains, terraces, and outwash plains. These soils formed in herbaceous organic deposits in deep depressions. Slopes are 0 to 1 percent.

Houghton soils are commonly near Milford, Palms, Pella, and Wallkill soils. Milford and Pella soils formed in deep mineral material, Palms soils have mineral sediments within a depth of 51 inches, and Wallkill soils have more than 16 inches of mineral sediments on the surface. These soils are in the higher positions on the landscape.

Typical pedon of Houghton muck, drained, in a cultivated field; 2,620 feet north and 1,690 feet west of the southeast corner of sec. 10, T. 24 N., R. 1 W.

Op—0 to 10 inches; black (N 2/0), broken face and rubbed, sapric material; 5 percent fiber, 1 percent rubbed; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Oa1—10 to 21 inches; black (N 2/0), broken face and rubbed, sapric material; 5 percent fiber, 1 percent rubbed; moderate coarse subangular blocky structure; friable; many fine roots; neutral; clear wavy boundary.

Oa2—21 to 30 inches; black (N 2/0), broken face and rubbed, sapric material; 10 percent fiber, 1 percent rubbed; moderate coarse subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.

Oa3—30 to 40 inches; black (N 2/0), broken face and rubbed, sapric material; 15 percent fiber, 1 percent rubbed; weak thick platy structure; friable; few fine roots; neutral; clear wavy boundary.

Oa4—40 to 48 inches; black (N 2/0), broken face and

rubbed, sapric material; 10 percent fiber, 1 percent rubbed; massive; friable; few fine roots; neutral; clear wavy boundary.

Oa5—48 to 60 inches; dark brown (7.5YR 3/2), broken face and rubbed, sapric material; 30 percent fiber, 5 percent rubbed; massive; friable; neutral.

The organic deposits are 60 inches to many feet thick. The organic layers have hue of 10YR, 7.5YR, or 5YR or are neutral in hue. They have value of 2 and chroma of 0 to 2. They are slightly acid or neutral. A thin layer of hemic material is in the lower part of some profiles.

Jules Series

The Jules series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Jules soils are commonly near Armiesburg and Stonelick soils. Armiesburg soils have a darker surface soil than the Jules soils, and Stonelick soils have more sand in the profile. Armiesburg and Stonelick soils are in the higher positions on the landscape.

Typical pedon of Jules silt loam, in a cultivated area of Jules-Stonelick complex, frequently flooded; 4,300 feet northeast of the northwest corner and 5,400 feet southeast of the northwest boundary of the J.W. and H. Connor Reserve, T. 26 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—9 to 14 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; many fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C2—14 to 20 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C3—20 to 41 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; few fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C4—41 to 60 inches; dark yellowish brown (10YR 4/4) very fine sandy loam; massive; friable; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 3. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam, but the range includes fine sandy loam, very fine sandy loam, or loam below a depth of 40 inches.

Kalamazoo Series

The Kalamazoo series consists of deep, well drained soils on outwash plains. These soils formed in loamy outwash over gravelly outwash. Permeability is moderate in the subsoil and very rapid in the underlying material. Slopes range from 0 to 6 percent.

Kalamazoo soils are commonly near Alvin and Ockley soils. Alvin soils have less clay in the upper part of the solum than the Kalamazoo soils. Also, they are higher on the landscape. Ockley soils have more clay throughout the solum than the Kalamazoo soils. They are in the lower positions on the landscape.

Typical pedon of Kalamazoo loam, 0 to 2 percent slopes, in a cultivated field; 3,510 feet east and 90 feet north of the southwest corner of sec. 34, T. 25 N., R. 3 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; brown (7.5YR 4/4) clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 4 percent gravel; slightly acid; clear wavy boundary.

Bt2—14 to 20 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark brown (7.5YR 3/4) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

Bt3—20 to 24 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (7.5YR 3/4) clay films on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary.

Bt4—24 to 28 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (7.5YR 3/4) clay films on faces of peds; about 8 percent gravel; medium acid; clear wavy boundary.

Bt5—28 to 34 inches; brown (7.5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; few fine roots; thin continuous dark brown

(7.5YR 3/4) clay films on faces of peds; about 8 percent gravel; medium acid; clear wavy boundary.

2Bt6—34 to 40 inches; dark brown (7.5YR 3/4) loamy coarse sand; weak coarse subangular blocky structure; very friable; few fine roots; dark brown (7.5YR 3/4) clay bridging on sand grains; about 10 percent gravel; slightly acid; clear wavy boundary.

2Bt7—40 to 50 inches; dark brown (7.5YR 3/4) gravelly loamy coarse sand; weak coarse subangular blocky structure; very friable; few fine roots; dark brown (7.5YR 3/4) clay bridging on sand grains; about 20 percent gravel; neutral; abrupt irregular boundary.

2C—50 to 60 inches; brown (10YR 5/3) gravelly coarse sand; single grained; loose; about 30 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 70 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is loam or sandy loam. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4. It is medium acid to neutral. The 2Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 4. It is loamy coarse sand or gravelly loamy coarse sand. It is medium acid to neutral. The 2C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Kendall Series

The Kendall series consists of deep, somewhat poorly drained, moderately permeable soils on outwash plains and till plains. These soils formed in silty material and in the underlying glacial outwash. Slopes are 0 to 1 percent.

Kendall soils are commonly near Camden, Cyclone, Fincastle, Patton, and Rockfield soils. Camden and Rockfield soils are browner in the subsoil than the Kendall soils. Also, they are higher on the landscape. Cyclone and Patton soils have a dark surface soil. They are in the lower positions on the landscape. Fincastle soils formed in a thinner deposit of silty material than the Kendall soils and are not stratified in the underlying material. They are in the higher positions on the landscape.

Typical pedon of Kendall silt loam, in a cultivated area of Kendall-Fincastle silt loams, 0 to 1 percent slopes; 975 feet east and 780 feet south of the northwest corner of sec. 29, T. 26 N., R. 1 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common medium roots; neutral; abrupt smooth boundary.

Bt1—10 to 16 inches; brown (10YR 4/3) silty clay loam; many fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—16 to 22 inches; brown (10YR 4/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) and many fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

Bt3—22 to 28 inches; brown (10YR 4/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) and many fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt4—28 to 35 inches; brown (10YR 4/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) and many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

Bt5—35 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; many fine distinct grayish brown (10YR 5/2) and many medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

BC—45 to 49 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; few fine roots; mildly alkaline; clear wavy boundary.

2C—49 to 60 inches; brown (10YR 5/3) loam; thin strata of silt loam and fine sandy loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak very coarse subangular blocky structure; massive; friable; about 4 percent gravel; strong effervescence; moderately alkaline.

The solum is 44 to 70 inches thick. The silty material is 44 to 60 inches thick. The depth to carbonates is 44 to 70 inches. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of

10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam or silt loam. Some pedons have a 2B horizon of loam or fine sandy loam. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is mildly alkaline or moderately alkaline.

Kendallville Series

The Kendallville series consists of deep, well drained soils on outwash plains. These soils formed in glacial outwash and in the underlying glacial till. Permeability is moderate in the upper part of the solum and moderately slow in the lower part of the solum and in the underlying material. Slopes range from 6 to 12 percent.

Kendallville soils are commonly near Ockley and Rush soils. Ockley and Rush soils are those that have a till substratum. They have thicker deposits of outwash above the underlying glacial till than the Kendallville soils. Also, they are higher on the landscape.

Typical pedon of Kendallville clay loam, in a cultivated area of Ockley, till substratum-Kendallville clay loams, 6 to 12 percent slopes, severely eroded; 1,225 feet east and 300 feet south of the northwest corner of sec. 22, T. 26 N., R. 2 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; about 10 percent gravel; medium acid; abrupt smooth boundary.

Bt1—7 to 15 inches; dark brown (7.5YR 4/4) gravelly clay loam; weak fine subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 17 percent gravel; strongly acid; clear wavy boundary.

Bt2—15 to 26 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 22 percent gravel; very strongly acid; abrupt wavy boundary.

2Bt3—26 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 4 percent gravel; medium acid; clear wavy boundary.

2Bt4—30 to 34 inches; dark yellowish brown (10YR 4/4) loam; moderate coarse subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.

2C—34 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 4 percent gravel; strong effervescence; moderately alkaline.

The solum is 25 to 40 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 4 to 6. It is clay loam, sandy clay loam, or their gravelly analogs. It is very strongly acid to medium acid. The 2Bt horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is clay loam or loam. It is medium acid to mildly alkaline. The 2C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Landes Series

The Landes series consists of deep, well drained and moderately well drained soils on flood plains. These soils formed in alluvium. Permeability is moderately rapid in the subsoil and rapid in the underlying material. Slopes range from 0 to 2 percent.

Landes soils are commonly near Ceresco, Ceresco Variant, Cohoctah, and Moundhaven soils. Ceresco, Ceresco Variant, and Cohoctah soils have gray in the subsoil. They are in the lower positions on the landscape. Moundhaven soils have less clay in the profile than the Landes soils and do not have a dark surface soil. Also, they are higher on the landscape.

Typical pedon of Landes fine sandy loam, in a cultivated area of Landes-Moundhaven complex, occasionally flooded; 350 feet north and 400 feet west of the southeast corner of sec. 26, T. 24 N., R. 1 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; common fine roots; neutral; clear wavy boundary.

Bw1—15 to 20 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw2—20 to 26 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; few fine roots; common discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; mildly alkaline; clear wavy boundary.

Bw3—26 to 34 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; friable; few fine roots; common discontinuous brown

(10YR 4/3) organic coatings on faces of peds; mildly alkaline; clear wavy boundary.

Bw4—34 to 39 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; common discontinuous brown (10YR 4/3) organic coatings on faces of peds; mildly alkaline; clear wavy boundary.

C1—39 to 46 inches; brown (10YR 4/3) loamy sand; single grained; loose; slight effervescence; mildly alkaline; clear wavy boundary.

C2—46 to 60 inches; brown (10YR 5/3) loamy sand; single grained; loose; strong effervescence; moderately alkaline.

The solum is 25 to 40 inches thick. The mollic epipedon is 10 to 18 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam and loam. The Bw horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. It is sandy loam, loam, very fine sandy loam, or fine sandy loam. It is neutral to moderately alkaline. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loamy fine sand, sandy loam, fine sand, loamy sand, or loam. A moderately wet phase of this series is mapped in the county.

Landes Variant

The Landes Variant consists of deep, well drained, moderately rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Landes Variant soils are commonly near Ceresco, Cohoctah, Cohoctah Variant, and Moundhaven soils. Ceresco, Cohoctah, and Cohoctah Variant soils have gray in the subsoil. Moundhaven soils have less clay in the profile than the Landes Variant soils and do not have a dark surface soil. The associated soils are in the lower positions on the landscape.

Typical pedon of Landes Variant fine sandy loam, in a cultivated area of Moundhaven-Landes Variant complex, frequently flooded; 1,715 feet south and 1,435 feet west of the northeast corner of sec. 33, T. 24 N., R. 1 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; common fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—10 to 14 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; common fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bw1—14 to 22 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; many continuous dark brown (10YR 3/3) organic coatings on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

Bw2—22 to 29 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; common discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; strong effervescence; mildly alkaline; clear wavy boundary.

Bw3—29 to 34 inches; brown (10YR 4/3) fine sandy loam; weak coarse subangular blocky structure; friable; strong effervescence; moderately alkaline; clear wavy boundary.

Bw4—34 to 39 inches; brown (10YR 4/3) very fine sandy loam; weak coarse subangular blocky structure; friable; strong effervescence; moderately alkaline; clear wavy boundary.

C1—39 to 46 inches; brown (10YR 4/3) sandy loam; massive; friable; strong effervescence; moderately alkaline; clear wavy boundary.

C2—46 to 60 inches; brown (10YR 5/3) loamy sand; single grained; loose; strong effervescence; moderately alkaline.

The solum is 25 to 40 inches thick. The mollic epipedon is 10 to 16 inches thick. The A horizon has hue of 10YR and value and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam and loam. The Bw horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. It is sandy loam, loam, very fine sandy loam, or fine sandy loam. It is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loamy fine sand, sandy loam, fine sand, loamy sand, or loam and is stratified.

Mahalasville Series

The Mahalasville series consists of deep, very poorly drained soils on glacial outwash plains and terraces. These soils formed in silty material and in glacial outwash. Generally, permeability is moderate. In the gravelly substratum phase, however, it is moderate in the subsoil and rapid in the underlying material. In the till substratum phase, it is moderate in the subsoil and

moderately slow in the underlying material. Slopes range from 0 to 2 percent.

Mahalasville soils are commonly near Crosier, Sleeth, Treaty, Waynetown, and Whitaker soils. Crosier, Sleeth, Waynetown, and Whitaker soils have brown in the subsoil. They are slightly higher on the landscape than the Mahalasville soils. Treaty soils are underlain with glacial till. They are in the higher positions on the landscape.

Typical pedon of Mahalasville silt loam, in a cultivated area of Mahalasville-Treaty silt loams; 200 feet south and 895 feet east of the northwest corner of sec. 6, T. 26 N., R. 1 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Btg1—11 to 17 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; firm; common fine roots; neutral; clear wavy boundary.

Btg2—17 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg3—22 to 29 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

2Btg4—29 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

2Btg5—36 to 43 inches; grayish brown (2.5Y 5/2) clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; few discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

2Btg6—43 to 48 inches; grayish brown (2.5Y 5/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; few discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2Btg7—48 to 53 inches; grayish brown (10YR 5/2) sandy loam; strata of loamy sand; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; few discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.

2Cg—53 to 60 inches; grayish brown (2.5Y 5/2) silt loam; thin strata of fine sandy loam and loamy sand; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The solum is 45 to 60 inches thick. The silty material is 25 to 40 inches thick. The mollic epipedon is 10 to 15 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam. The Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 or 2. The 2Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 or 2. Gravelly substratum and till substratum phases of this series are mapped in the county.

Martinsville Series

The Martinsville series consists of deep, well drained, moderately permeable soils on till plains. These soils formed in glacial outwash over glacial till. Slopes range from 2 to 12 percent.

Martinsville soils are commonly near Crosby, Fincastle, Miami, and Washtenaw soils. Crosby, Fincastle, and Washtenaw soils have a grayer subsoil than the Martinsville soils. Also, they are lower on the landscape. Miami soils are more shallow to glacial till than the Martinsville soils and are more sloping.

Typical pedon of Martinsville loam, till substratum, in a cultivated area of Martinsville, till substratum-Miami loams, 2 to 6 percent slopes, eroded; 2,300 feet east and 2,524 feet north of the southwest corner of sec. 14, T. 23 N., R. 1 W.

Ap—0 to 8 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; 20 percent dark yellowish brown (10YR 4/4) clay loam subsoil material; weak coarse granular structure; friable; many fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; dark yellowish brown (10YR 4/4)

clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

Bt2—14 to 22 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 1 percent gravel; medium acid; clear wavy boundary.

Bt3—22 to 27 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 2 percent gravel; strongly acid; clear wavy boundary.

Bt4—27 to 35 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 6 percent gravel; strongly acid; clear wavy boundary.

Bt5—35 to 44 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 6 percent gravel; medium acid; clear wavy boundary.

Bt6—44 to 50 inches; dark brown (7.5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt7—50 to 56 inches; dark brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt8—56 to 65 inches; dark brown (7.5YR 4/4) sandy clay loam; weak coarse subangular blocky structure; friable; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.

2C—65 to 80 inches; brown (10YR 5/3) loam; massive; firm; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 55 to 70 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is loam or silt loam, but in severely eroded pedons the range includes clay loam. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4. The 2C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Miami Series

The Miami series consists of deep, well drained soils on till plains. These soils formed in glacial till. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 2 to 20 percent.

Miami soils are commonly near Crosby, Crosier, Fincastle, Martinsville, Riddles, and Washtenaw soils. Crosby, Crosier, Fincastle, and Washtenaw soils are gray in the subsoil. They are in the lower positions on the landscape. Martinsville and Riddles soils have a deeper solum than the Miami soils and are less sloping.

Typical pedon of Miami loam, in a cultivated area of Martinsville, till substratum-Miami loams, 2 to 6 percent slopes, eroded; 2,400 feet east and 2,500 feet north of the southwest corner of sec. 14, T. 23 N., R. 1 W.

Ap—0 to 8 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; 20 percent dark yellowish brown (10YR 4/4) clay loam subsoil material; weak fine granular structure; friable; many fine roots; about 5 percent gravel; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine subangular blocky structure; firm; many fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary.

Bt2—14 to 29 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

Bt3—29 to 35 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; common fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

C—35 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The depth to carbonates is 20 to 36 inches. The Ap horizon has hue

of 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly loam, but the range includes silt loam. In severely eroded areas, it includes clay loam and silty clay loam. The Bt horizon has hue of 10YR, value of 4, and chroma of 4 to 6. It is medium acid or strongly acid in the upper part and neutral in the lower part. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Milford Series

The Milford series consists of deep, very poorly drained, moderately slowly permeable soils on till plains and glacial lake plains. These soils formed in lacustrine sediments. Slopes range from 0 to 2 percent.

Milford soils are commonly near Houghton, Palms, and Wallkill soils. Houghton and Palms soils formed in more than 16 inches of organic deposits, and Wallkill soils are underlain by organic deposits. These soils are in the lower positions on the landscape.

Typical pedon of Milford silty clay loam, in a cultivated field; 1,700 feet west and 250 feet south of the northeast corner of sec. 11, T. 24 N., R. 1 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak coarse granular structure; firm; many fine roots; neutral; abrupt smooth boundary.

A—10 to 14 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak coarse granular structure; firm; many fine roots; neutral; clear wavy boundary.

BA—14 to 22 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg1—22 to 32 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine distinct grayish brown (10YR 5/2) and many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; neutral; clear wavy boundary.

Bg2—32 to 38 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct grayish brown (10YR 5/2) and many fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; common fine roots; slightly acid; clear wavy boundary.

Bg3—38 to 42 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; common fine roots; slightly acid; clear wavy boundary.

Bg4—42 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; slightly acid; gradual wavy boundary.

Bg5—48 to 53 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; slightly acid; gradual wavy boundary.

Bg6—53 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; neutral; clear wavy boundary.

Bg7—60 to 70 inches; dark grayish brown (2.5Y 4/2) silty clay loam; strata of silt loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; neutral; clear wavy boundary.

Cg—70 to 80 inches; grayish brown (2.5Y 5/2) silty clay loam; strata of silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; mildly alkaline.

The solum is 60 to 80 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam. The Bg horizon has hue of 2.5Y, 5Y, or 10YR, value of 3 to 5, and chroma of 1 or 2. It is slightly acid to mildly alkaline. The Cg horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 1 to 4. It has sandy loam strata in some pedons. A pothole phase of this series is mapped in the county.

Millsdale Series

The Millsdale series consists of moderately deep, very poorly drained, moderately slowly permeable soils on bedrock terraces. These soils formed in loamy outwash over limestone bedrock. Slopes range from 0 to 2 percent.

The Millsdale soils in this county have less clay in the solum than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of these soils.

Millsdale soils are commonly near Milton Variant, Mudlavia Variant, and Palms Variant soils. Milton

Variant and Mudlavia Variant soils have a brown subsoil that does not have gray mottles. They do not have a dark surface layer. They are in the higher positions on the landscape. Palms Variant soils have a 16- to 40-inch organic deposit over bedrock. They are in the lower positions on the landscape.

Typical pedon of Millsdale loam, in a cultivated field; 890 feet west and 595 feet north of the southeast corner of sec. 9, T. 26 N., R. 1 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; about 11 percent gravel; neutral; abrupt wavy boundary.

A1—8 to 12 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; about 5 percent gravel; neutral; clear wavy boundary.

A2—12 to 18 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common fine roots; about 3 percent gravel; neutral; clear wavy boundary.

Btg1—18 to 29 inches; dark gray (10YR 4/1) clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.

2Btg2—29 to 35 inches; dark grayish brown (2.5Y 4/2) gravelly clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 18 percent gravel; mildly alkaline; clear wavy boundary.

3R—35 inches; consolidated limestone bedrock.

The thickness of the solum ranges from 20 to 40 inches and coincides with the depth to bedrock. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loam or silt loam. The Btg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is slightly acid or neutral. The 2Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is mildly alkaline or moderately alkaline.

Milton Variant

The Milton Variant consists of shallow, well drained, moderately permeable soils on bedrock terraces. These soils formed in silty sediments over bedrock. Slopes range from 1 to 4 percent.

Milton Variant soils are commonly near Millsdale and Mudlavia Variant soils. Mudlavia Variant soils have more clay in the subsoil than the Milton Variant soils, and Millsdale soils have a thicker, darker surface layer. Millsdale and Mudlavia Variant soils are in the lower positions on the landscape.

Typical pedon of Milton Variant channery silt loam, 1 to 4 percent slopes, flaggy, in a cultivated field; 1,245 feet north and 995 feet west of the southeast corner of sec. 9, T. 26 N., R. 1 W.

Ap—0 to 4 inches; brown (10YR 4/3) channery silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; about 15 percent channers and 5 percent flags; neutral; abrupt wavy boundary.

Bt1—4 to 9 inches; brown (10YR 4/3) very channery silt loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 35 percent channers and 10 percent flags; very slight effervescence; mildly alkaline; clear wavy boundary.

Bt2—9 to 12 inches; brown (10YR 4/3) very channery silt loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 40 percent channers and 10 percent flags; slight effervescence; mildly alkaline; clear wavy boundary.

R—12 inches; consolidated limestone bedrock.

The thickness of the solum ranges from 10 to 20 inches and coincides with the depth to bedrock. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR and value and chroma of 3 or 4. It is neutral or mildly alkaline.

Moundhaven Series

The Moundhaven series consists of deep, somewhat excessively drained, rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Moundhaven soils are commonly near Ceresco, Cohoctah, Cohoctah Variant, Landes, and Landes Variant soils. Ceresco, Cohoctah, and Cohoctah Variant soils have gray in the subsoil. Landes and Landes Variant soils have a darker surface soil and more clay in the subsoil and underlying material than the Moundhaven soils. The associated soils are in the lower positions on the landscape.

Typical pedon of Moundhaven loamy fine sand, in a cultivated area of Moundhaven-Landes Variant complex, frequently flooded; 1,595 feet south and 1,735 feet west of the northeast corner of sec. 33, T. 24 N., R. 1 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak coarse granular structure; very friable; common fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—9 to 14 inches; dark brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak coarse granular structure; very friable; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bw1—14 to 18 inches; brown (10YR 4/3) loamy fine sand; weak fine subangular blocky structure; very friable; few fine roots; strong effervescence; moderately alkaline; diffuse wavy boundary.

Bw2—18 to 31 inches; brown (10YR 4/3) loamy fine sand; weak fine subangular blocky structure; very friable; few fine roots; strong effervescence; moderately alkaline; diffuse wavy boundary.

Bw3—31 to 38 inches; brown (10YR 4/3) loamy fine sand; weak fine subangular blocky structure; very friable; few fine roots; strong effervescence; moderately alkaline; diffuse wavy boundary.

C—38 to 60 inches; brown (10YR 5/3) sand; single grained; loose; strong effervescence; moderately alkaline.

The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loamy sand or sand.

Mudlavia Series

The Mudlavia series consists of deep, well drained soils on terraces. These soils formed in gravelly loamy sediments over sand and very gravelly coarse sand. Permeability is moderate in the subsoil and very rapid in the underlying material. Slopes range from 1 to 3 percent.

Mudlavia soils are commonly near Coloma, Mudlavia Variant, Ormas, and Westland soils. Coloma soils have less clay and fewer coarse fragments throughout the solum than the Mudlavia soils. Also, they are higher on the landscape. Mudlavia Variant soils are underlain by limestone bedrock. They are in the higher areas on the landscape. Ormas soils have less clay and fewer coarse fragments in the upper part of the subsoil than the Mudlavia soils. Also, they are higher on the landscape. Westland soils have a gray subsoil. They are in the lower positions on the landscape.

Typical pedon of Mudlavia gravelly sandy loam, 1 to 3 percent slopes, in a cultivated field; 3,700 feet west of the southeast corner and 2,300 feet north of the south boundary of the A. Bondle Reserve, T. 25 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) gravelly sandy loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; about 25 percent gravel and about 5 percent cobbles; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; brown (7.5YR 4/4) very gravelly clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 40 percent gravel and 15 percent cobbles; medium acid; clear wavy boundary.

Bt2—14 to 20 inches; brown (7.5YR 4/4) very gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 35 percent gravel and 15 percent cobbles; medium acid; clear wavy boundary.

Bt3—20 to 25 inches; brown (7.5YR 4/4) very gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 40 percent gravel and 15 percent cobbles; medium acid; clear wavy boundary.

Bt4—25 to 31 inches; brown (7.5YR 4/4) extremely gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 45 percent gravel and 20 percent cobbles; slightly acid; clear wavy boundary.

Bt5—31 to 39 inches; brown (7.5YR 4/4) extremely gravelly clay loam; weak medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 40 percent gravel and 20 percent cobbles; neutral; clear wavy boundary.

Bt6—39 to 45 inches; dark reddish brown (5YR 3/2) extremely gravelly clay; weak coarse subangular blocky structure; firm; few fine roots; dark brown (10YR 3/3) clay films on faces of peds; about 45 percent gravel and 15 percent cobbles; neutral; clear wavy boundary.

C—45 to 60 inches; brown (10YR 5/3) extremely gravelly coarse sand; single grained; loose; about 55 percent gravel and 15 percent cobbles; strong effervescence; moderately alkaline.

The solum is 40 to 70 inches thick. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 3. The Bt horizon has hue of 7.5YR or 5YR and value and chroma of 4. It is clay loam or clay or their extremely gravelly or very gravelly analogs. The 2C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Mudlavia Variant

The Mudlavia Variant consists of moderately deep, well drained, moderately permeable soils on bedrock terraces. These soils formed in gravelly loamy sediments over limestone bedrock. Slopes range from 0 to 2 percent.

Mudlavia Variant soils are commonly near Millsdale, Milton Variant, and Mudlavia soils. Millsdale soils are gray in the subsoil. They are in the lower positions on the landscape. Milton Variant soils have limestone bedrock within a depth of 20 inches. They are in the higher positions on the landscape. Mudlavia soils are underlain by very gravelly coarse sand. They are in the higher positions on the landscape.

Typical pedon of Mudlavia Variant gravelly loam, 0 to 2 percent slopes, in a cultivated field; 900 feet west and 185 feet north of the southeast corner of sec. 26, T. 26 N., R. 2 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; about 25 percent gravel and 5 percent cobbles; neutral; abrupt smooth boundary.

Bt1—7 to 11 inches; dark yellowish brown (10YR 4/4) very gravelly clay loam; moderate medium subangular blocky structure; firm; many fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 35 percent gravel and 15 percent cobbles; slightly acid; clear wavy boundary.

Bt2—11 to 17 inches; brown (7.5YR 4/4) very gravelly clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 35 percent gravel and 15 percent cobbles; slightly acid; clear wavy boundary.

Bt3—17 to 21 inches; brown (7.5YR 4/4) very gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 35 percent gravel and 15 percent cobbles; neutral; clear wavy boundary.

Bt4—21 to 25 inches; brown (7.5YR 4/4) extremely cobbly clay loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 35 percent gravel and 35 percent cobbles; neutral; clear wavy boundary.

Bt5—25 to 30 inches; brown (7.5YR 4/4) extremely cobbly clay loam; weak coarse subangular blocky structure; firm; few fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 35 percent gravel and 35 percent cobbles; neutral; clear wavy boundary.

2R—30 inches; consolidated limestone bedrock.

The thickness of the solum ranges from 20 to 40 inches and coincides with the depth to bedrock. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 3. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4. It is the very gravelly, very cobbly, or extremely cobbly analogs of clay loam.

Ockley Series

The Ockley series consists of deep, well drained soils on outwash plains and terraces. These soils formed in silty material and in glacial outwash. Generally, permeability is moderate in the subsoil and very rapid in the underlying material. In the till substratum phase, however, it is moderate. Slopes range from 0 to 12 percent.

Ockley soils are commonly near Alvin, Fox, Kendallville, Rush, Sleeth, Waynetown, and Westland soils. Alvin and Kendallville soils have less clay in the solum than the Ockley soils. Also, they are higher on the landscape. Fox soils are deeper to very gravelly coarse sand than the Ockley soils. Also, they are lower on the landscape. Rush soils are less sloping and formed in a thicker deposit of silty material than the Ockley soils. Sleeth and Waynetown soils have gray mottles in the upper part of the solum. They are in the lower positions on the landscape. Westland soils have a gray subsoil. They are in depressions.

Typical pedon of Ockley silt loam, 0 to 2 percent slopes, in a cultivated field; 900 feet east and 2,500 feet north of the southwest corner of sec. 16, T. 25 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; many fine roots; thin discontinuous

dark brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—14 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt3—18 to 27 inches; brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (7.5YR 3/4) clay films on faces of peds; about 3 percent gravel; medium acid; clear wavy boundary.

2Bt4—27 to 35 inches; brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (7.5YR 3/4) clay films on faces of peds; about 6 percent gravel; medium acid; clear wavy boundary.

3Bt5—35 to 48 inches; brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (7.5YR 3/4) clay films on faces of peds; about 18 percent gravel; medium acid; clear wavy boundary.

3Bt6—48 to 56 inches; dark brown (10YR 3/3) gravelly clay loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 22 percent gravel; medium acid; abrupt irregular boundary.

3C—56 to 60 inches; brown (10YR 5/3) very gravelly coarse sand; single grained; loose; about 35 percent gravel; strong effervescence; moderately alkaline.

The solum is 45 to 70 inches thick. The silty material is 0 to 20 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 4 to 6. It is strongly acid to slightly acid. The 2Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 4 to 6. It is clay loam or sandy clay loam. It is strongly acid to slightly acid. The 3Bt horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. It is gravelly clay loam or gravelly sandy clay loam. It is medium acid or slightly acid. The 3C horizon has hue of 10YR, value of 5, and chroma of 3 or 4. A till substratum phase of this series is mapped in the county.

Ormas Series

The Ormas series consists of deep, well drained soils on terraces. These soils formed in wind-reworked sediments over glacial outwash. Permeability is rapid in the upper part of the solum, moderately rapid in the lower part of the solum, and very rapid in the underlying material. Slopes range from 0 to 6 percent.

Ormas soils are commonly near Coloma, Fox, and Mudlavia soils. Coloma soils have a Bt horizon, in the form of lamellae and bands, that has less clay than that of the Ormas soils. Also, they are higher on the landscape. Fox soils are moderately deep to sand and very gravelly coarse sand. Mudlavia soils have more clay and coarse fragments in the subsoil than the Ormas soils. Fox and Mudlavia soils are in the lower positions on the landscape.

Typical pedon of Ormas loamy sand, 0 to 2 percent slopes, in a cultivated field; 1,140 feet north and 2,855 feet east of the southwest corner of sec. 16, T. 25 N., R. 3 W.

Ap—0 to 9 inches; dark yellowish brown (10YR 3/4) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; common fine roots; medium acid; abrupt smooth boundary.

E1—9 to 14 inches; brown (10YR 5/3) loamy sand; weak fine subangular blocky structure; very friable; few fine roots; slightly acid; diffuse wavy boundary.

E2—14 to 23 inches; yellowish brown (10YR 5/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; diffuse wavy boundary.

E3—23 to 33 inches; yellowish brown (10YR 5/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; about 2 percent gravel; slightly acid; clear wavy boundary.

Bt1—33 to 40 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 3 percent gravel; strongly acid; clear wavy boundary.

2Bt2—40 to 48 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 15 percent gravel; medium acid; clear wavy boundary.

2Bt3—48 to 55 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 20 percent gravel; neutral; abrupt irregular boundary.

2C—55 to 70 inches; brown (10YR 5/3) very gravelly coarse sand; single grained; loose; about 45 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 50 to 70 inches and coincides with the depth to calcareous gravelly coarse sand. The A and E horizons have hue of 10YR, value of 3 to 5, and chroma of 3 or 4. They are dominantly loamy sand, but the range includes loamy fine sand and sand. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is strongly acid or medium acid. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is gravelly coarse sandy loam or gravelly sandy clay loam. The 2C horizon is gravelly coarse sand or very gravelly coarse sand.

Palms Series

The Palms series consists of deep, very poorly drained soils on terraces, outwash plains, and till plains. These soils formed in herbaceous organic deposits over mineral deposits. Generally, permeability is moderately slow to moderately rapid in the organic part and moderate or moderately slow in the mineral part. In the cobbly substratum phase, however, it is moderate or moderately rapid in the organic part and moderate in the underlying material. Slopes range from 0 to 2 percent.

Palms soils are commonly near Houghton, Milford, Pella, and Wallkill soils. Houghton soils do not have mineral material within a depth of 51 inches. They are in the lower positions on the landscape. Milford and Pella soils formed entirely in mineral material. They are in the slightly higher positions on the landscape. Wallkill soils have more than 16 inches of mineral deposits on the surface. They are in the lower positions on the landscape.

Typical pedon of Palms muck, drained, in a cultivated field; 450 feet west and 2,550 feet north of the southeast corner of sec. 22, T. 24 N., R. 1 W.

Op—0 to 10 inches; black (N 2/0), broken face and rubbed, sapric material; 5 percent fiber, 1 percent rubbed; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Oa—10 to 19 inches; black (N 2/0), broken face and rubbed, sapric material; 5 percent fiber, 1 percent rubbed; moderate coarse subangular blocky structure; friable, few fine roots; neutral; abrupt smooth boundary.

2Cg1—19 to 23 inches; very dark gray (10YR 3/1) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; neutral; clear wavy boundary.

2Cg2—23 to 26 inches; dark gray (10YR 4/1) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; neutral; clear wavy boundary.

2Cg3—26 to 30 inches; dark gray (5Y 4/1) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; slight effervescence; mildly alkaline; clear wavy boundary.

2Cg4—30 to 38 inches; gray (5Y 5/1) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg5—38 to 60 inches; gray (5Y 5/1) silty clay loam; strata of silt loam; few medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; strong effervescence; moderately alkaline.

The organic deposits are 16 to 39 inches thick. They are slightly acid to neutral. The organic layers have hue of 10YR or 7.5YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 2. The 2Cg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam, silt loam, loam, or clay loam. A cobbly substratum phase of this series is mapped in the county.

Palms Variant

The Palms Variant consists of moderately deep, very poorly drained soils on bedrock terraces. These soils formed in herbaceous organic deposits and mineral deposits over limestone bedrock. Permeability is moderately rapid in the organic part and moderately slow in the mineral part. Slopes range from 0 to 2 percent.

Palms Variant soils are commonly near Millsdale soils, which are mineral soils. Millsdale soils are in the higher positions on the landscape.

Typical pedon of Palms Variant muck, drained, in a cultivated field; 3,600 feet north of the southeast corner and 350 feet west of the east boundary of the Z. Cicott Reserve, T. 26 N., R. 1 W.

Op—0 to 10 inches; black (N 2/0), broken face and rubbed, sapric material; 5 percent fiber, 1 percent rubbed; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

Oa1—10 to 16 inches; black (N 2/0), broken face and

rubbed, sapric material; 5 percent fiber, 1 percent rubbed; moderate medium subangular blocky structure; friable; many fine roots; slightly acid; gradual smooth boundary.

Oa2—16 to 32 inches; black (N 2/0), broken face and rubbed, sapric material; 5 percent fiber, 1 percent rubbed; weak coarse subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

2Cg—32 to 36 inches; dark grayish brown (2.5Y 4/2) silty clay loam; massive; firm; strong effervescence; moderately alkaline; abrupt smooth boundary.

3R—36 inches; consolidated limestone bedrock.

The organic deposits are 16 to 39 inches thick. The depth to bedrock is 20 to 40 inches. The organic layers have hue of 10YR, 7.5YR, or 5YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 2. The 2Cg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam, silt loam, loam, or clay loam.

Patton Series

The Patton series consists of deep, poorly drained soils on outwash plains. These soils formed in silty material. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 2 percent.

Patton soils are similar to Cyclone, Pella, and Treaty soils and are commonly near Camden, Kendall, and Starks soils. Cyclone soils have thicker deposits of silty material than the Patton soils. Pella soils have carbonates within 40 inches of the surface. Treaty soils have thinner deposits of silty material than the Patton soils and are underlain by glacial till. Camden, Kendall, and Starks soils are brown in the subsoil and do not have a dark surface soil. Camden soils are in the higher positions on the landscape. Kendall and Starks soils are slightly higher on the landscape than the Patton soils.

Typical pedon of Patton silty clay loam, in a cultivated field; 1,750 feet south and 75 feet west of the northeast corner of sec. 10, T. 25 N., R. 1 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—9 to 14 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak coarse granular structure; friable; many fine roots; neutral; clear wavy boundary.

Bg1—14 to 21 inches; dark gray (10YR 4/1) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; many fine roots; neutral; clear wavy boundary.

Bg2—21 to 27 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg3—27 to 32 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg4—32 to 38 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct dark grayish brown (10YR 4/2) and many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg5—38 to 43 inches; grayish brown (2.5Y 5/2) silty clay loam; few medium distinct dark grayish brown (10YR 4/2) and many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg6—43 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct dark grayish brown (10YR 4/2) and many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

BCg—48 to 54 inches; gray (10YR 5/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; neutral; clear wavy boundary.

Cg1—54 to 58 inches; gray (10YR 5/1) silt loam; strata of silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; mildly alkaline; clear wavy boundary.

Cg2—58 to 65 inches; grayish brown (10YR 5/2) silty clay loam; strata of silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; mildly alkaline.

The solum is 40 to more than 48 inches thick. The mollic epipedon is 10 to 15 inches thick. The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is neutral or mildly alkaline. The Cg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is stratified silty

clay loam and silt loam. It is neutral or mildly alkaline.

Pella Series

The Pella series consists of deep, poorly drained, moderately permeable soils in depressions on till plains, terraces, and outwash plains. These soils formed in lacustrine deposits. Slopes are 0 to 1 percent.

Pella soils are similar to Cyclone, Patton, and Treaty soils and are commonly near Houghton and Palms soils. Cyclone soils have more clay in the subsoil than the Pella soils. Patton soils have carbonates at a depth of more than 40 inches. Treaty soils are underlain by glacial till. Houghton and Palms soils formed in organic deposits. They are in the lower positions on the landscape.

Typical pedon of Pella silty clay loam, in a cultivated field; 143 feet west and 2,425 feet north of the southeast corner of sec. 28, T. 25 N., R. 1 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—9 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate coarse granular structure; friable; few fine roots; neutral; clear wavy boundary.

Btg1—15 to 22 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg2—22 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btg3—26 to 32 inches; gray (5Y 5/1) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

BCg—32 to 37 inches; olive gray (5Y 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Cg1—37 to 47 inches; gray (5Y 5/1) silt loam; common medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—47 to 60 inches; gray (5Y 5/1) silt loam; thin strata of sandy loam; few fine distinct yellowish brown (10YR 5/8) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum is 30 to 48 inches thick. The depth to carbonates is 16 to 40 inches. The mollic epipedon is 10 to 15 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam. The Btg horizon has hue of 2.5Y, 5Y, or 10YR, value of 4 or 5, and chroma of 1 or 2. The BCg horizon has hue of 5Y or 10YR, value of 5, and chroma of 1 to 4. It is silty clay loam or silt loam. It is mildly alkaline or moderately alkaline. The Cg horizon is mottled and has hue of 5Y, 2.5Y, or 10YR, value of 5, and chroma of 1 to 6. Silty clay loam strata are in some pedons.

Piankeshaw Variant

The Piankeshaw Variant consists of deep, well drained, moderately rapidly permeable soils on alluvial fans. These soils formed in alluvium. Slopes range from 2 to 8 percent.

Piankeshaw Variant soils are commonly near Warners Variant soils. Warners Variant soils have a gray profile. They are in seepage areas near the bottom of very steep slopes.

Typical pedon of Piankeshaw Variant gravelly sandy loam, rarely flooded, 2 to 8 percent slopes, in a cultivated field; 5,050 feet northeast of the northwest corner and 5,450 feet southeast of the northwest boundary of the J.W. and H. Connor Reserve, T. 26 N., R. 2 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) gravelly sandy loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; about 25 percent gravel and 5 percent cobbles; strong effervescence; moderately alkaline; abrupt smooth boundary.

A—8 to 16 inches; dark brown (10YR 3/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; common fine roots; about 25 percent gravel and 10 percent cobbles; strong effervescence; moderately alkaline; clear wavy boundary.

C1—16 to 30 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam; massive; friable; few fine roots; about 40 percent gravel and 4 percent cobbles; violent effervescence; moderately alkaline; clear wavy boundary.

C2—30 to 36 inches; brown (10YR 5/3) gravelly sandy loam; massive; friable; few fine roots; about 19 percent gravel; violent effervescence; moderately alkaline; clear wavy boundary.

C3—36 to 45 inches; brown (10YR 4/3) gravelly sandy loam; massive; friable; about 21 percent gravel; violent effervescence; moderately alkaline; clear wavy boundary.

C4—45 to 51 inches; brown (10YR 5/3) very gravelly loamy coarse sand; single grained; loose; about 25 percent gravel and 13 percent cobbles; violent effervescence; moderately alkaline; clear wavy boundary.

C5—51 to 60 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam; massive; friable; about 21 percent gravel; violent effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 3. It is gravelly sandy loam or gravelly loam. The C horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4.

Riddles Series

The Riddles series consists of deep, well drained, moderately permeable soils on till plains. These soils formed in glacial till. Slopes range from 2 to 18 percent.

Riddles soils are commonly near Alvin, Crosier, Miami, and Whitaker soils. Alvin soils have less clay in the subsoil and underlying material than the Riddles soils. Crosier and Whitaker soils have gray mottles in the subsoil. They are in the lower positions on the landscape. Miami soils are more shallow to glacial till and are more sloping than the Riddles soils.

Typical pedon of Riddles loam, in a cultivated area of Riddles-Miami loams, 2 to 6 percent slopes, eroded; 800 feet west and 200 feet north of the southeast corner of sec. 11, T. 26 N., R. 2 W.

Ap—0 to 8 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; 20 percent dark yellowish brown (10YR 4/4) clay loam subsoil material; weak coarse granular structure; friable; many fine roots; about 5 percent gravel; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; many fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt2—14 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt3—20 to 28 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt4—28 to 41 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt5—41 to 45 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 4 percent gravel; strongly acid; clear wavy boundary.

Bt6—45 to 49 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary.

Bt7—49 to 56 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary.

Bt8—56 to 66 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2C—66 to 80 inches; brown (10YR 5/3) loam; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 50 to 70 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It generally is loam, silt loam, or sandy loam, but in

severely eroded areas the range includes clay loam. The Bt horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 4 to 6. It is clay loam, sandy clay loam, or sandy loam. It is strongly acid to neutral. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Rockfield Series

The Rockfield series consists of deep, moderately well drained soils on till plains. These soils formed in silty material and in the underlying glacial outwash and glacial till. Permeability is moderate in the upper part of the subsoil and moderately slow in the lower part of the subsoil and in the underlying material. Slopes range from 0 to 6 percent.

Rockfield soils are commonly near Fincastle and Williamstown soils. Fincastle soils are grayer in the subsoil than the Rockfield soils. Also, they are lower on the landscape. Williamstown soils formed in a thinner deposit of silty material than the Rockfield soils. Also, they are more shallow to glacial till and are more sloping.

Typical pedon of Rockfield silt loam, in a cultivated area of Rockfield-Williamstown complex, 1 to 6 percent slopes, eroded; 2,310 feet east and 1,825 feet south of the northwest corner of sec. 22, T. 24 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; 20 percent dark yellowish brown (10YR 4/6) silty clay loam subsoil material; weak fine granular structure; friable; many fine roots; very strongly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/6) silty clay loam; weak fine subangular blocky structure; firm; many fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—14 to 20 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—20 to 26 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt4—26 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; very strongly acid; clear wavy boundary.

2Bt5—32 to 37 inches; dark brown (7.5YR 4/4) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 3 percent gravel; strongly acid; clear wavy boundary.

2Bt6—37 to 43 inches; dark brown (7.5YR 4/4) sandy clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 6 percent gravel; strongly acid; clear wavy boundary.

2Bt7—43 to 48 inches; brown (7.5YR 4/4) sandy loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; friable; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

3Bt8—48 to 53 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.

3BCt—53 to 57 inches; brown (10YR 4/3) loam; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few fine roots; few discontinuous brown (10YR 4/3) clay films on faces of peds; about 4 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

3C—57 to 65 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 45 to 60 inches thick. The silty material is 24 to 40 inches thick. The depth to the 3Bt horizon is 45 to 55 inches. The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 4 to 6. It is strongly acid or medium acid. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4, and chroma of 3 to 6. It is strongly acid to slightly acid. It is sandy loam, sandy clay loam, or clay loam. The 3Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4. It is neutral or mildly alkaline. The 3C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Ross Series

The Ross series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Ross soils are similar to Armiesburg soils. Armiesburg soils have more silt and less sand in the subsoil than the Ross soils and have a thinner surface soil.

Typical pedon of Ross loam, rarely flooded, in a cultivated field; 7,500 feet west of the southeast corner and 3,300 feet north of the south boundary of the A. Bondie Reserve, T. 25 N., R. 2 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—10 to 16 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.

Bw1—16 to 22 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate coarse subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.

Bw2—22 to 29 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw3—29 to 35 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; friable; few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bw4—35 to 50 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; few fine roots; about 2 percent gravel; neutral; clear wavy boundary.

2Bt1—50 to 66 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

3Bt2—66 to 80 inches; dark brown (7.5YR 3/4) gravelly clay loam; moderate medium subangular blocky structure; firm; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 18 percent gravel; mildly alkaline.

The solum is 65 to 80 inches thick. The mollic epipedon is typically 24 to 35 inches thick. The A horizon has hue of 10YR, value of 3, and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. The Bw horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is loam or sandy loam. The 2Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4. It is loam, sandy clay loam, or sandy loam. It is neutral or mildly alkaline. The 3Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 4. It is gravelly sandy loam, gravelly sandy clay loam, or gravelly clay loam. Some pedons have a C horizon, which has hue of 10YR, value of 5, and chroma of 3 or 4.

Rush Series

The Rush series consists of deep, well drained soils on outwash plains. These soils formed in silty material and in the underlying glacial outwash. Generally, permeability is moderate in the subsoil and very rapid in the underlying material. In the till substratum phase, however, it is moderate. Slopes range from 0 to 2 percent.

Rush soils are commonly near Ockley and Waynetown soils. Ockley soils are more sloping and formed in a thinner deposit of silty material than the Rush soils. Waynetown soils have a gray subsoil. They are slightly lower on the landscape than the Rush soils.

Typical pedon of Rush silt loam, 0 to 2 percent slopes, in a cultivated field; 800 feet east and 3,075 feet north of the southwest corner of sec. 21, T. 25 N., R. 1 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 15 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—15 to 22 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt3—22 to 29 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt4—29 to 35 inches; brown (7.5YR 4/4) clay loam;

moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 8 percent gravel; strongly acid; clear wavy boundary.

3Bt5—35 to 40 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 25 percent gravel; medium acid; clear wavy boundary.

3Bt6—40 to 44 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 16 percent gravel; medium acid; clear wavy boundary.

3Bt7—44 to 49 inches; dark brown (7.5YR 4/4) gravelly clay loam; weak coarse subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 16 percent gravel; slightly acid; clear wavy boundary.

3Bt8—49 to 56 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak coarse subangular blocky structure; friable; few discontinuous dark brown (7.5YR 3/4) clay films on faces of peds; about 18 percent gravel; neutral; abrupt irregular boundary.

4C—56 to 65 inches; brown (10YR 5/3) very gravelly coarse sand; single grained; loose; about 55 percent gravel; strong effervescence; moderately alkaline.

The solum is 55 to 70 inches thick. The silty material is 24 to 38 inches thick. The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 6. It is strongly acid to slightly acid. The 2Bt horizon has hue of 10YR or 7.5YR. It is clay loam or sandy clay loam. It is very strongly acid to medium acid. The 3Bt horizon has hue of 10YR or 7.5YR. It is gravelly sandy clay loam, gravelly sandy loam, or gravelly clay loam. It is strongly acid to neutral. The 4C horizon has chroma of 3 or 4. It is very gravelly coarse sand or gravelly coarse sand. A till substratum phase of this series is mapped in the county.

Sleeth Series

The Sleeth series consists of deep, somewhat poorly drained soils on outwash plains. These soils formed in silty material and in the underlying glacial outwash over glacial till. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes are 0 to 1 percent.

Sleeth soils are commonly near Mahalasville, Ockley, Rush, and Waynetown soils, all of which have a till substratum. Mahalasville soils have a dark surface soil. They are in the lower positions on the landscape. Ockley and Rush soils have a brown subsoil and do not have gray mottles. They are in the higher positions on the landscape. Waynetown soils formed in a thicker deposit of silty material than the Sleeth soils. Also, they are slightly lower on the landscape.

Typical pedon of Sleeth silt loam, till substratum, in a cultivated area of Waynetown-Sleeth silt loams, till substrata, 0 to 1 percent slopes; 2,820 feet west and 110 feet south of the northeast corner of sec. 3, T. 25 N., R. 3 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—8 to 12 inches; brown (10YR 4/3) silty clay loam; many fine distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; firm; many fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—12 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; many fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt3—18 to 23 inches; brown (10YR 4/3) clay loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

2Bt4—23 to 28 inches; brown (10YR 4/3) clay loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 8 percent gravel; slightly acid; clear wavy boundary.

2Bt5—28 to 34 inches; dark yellowish brown (10YR 4/4) clay loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown

(10YR 4/2) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

3Btg1—34 to 40 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate coarse subangular blocky structure; firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 23 percent gravel; neutral; clear wavy boundary.

3Btg2—40 to 48 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 23 percent gravel; neutral; abrupt wavy boundary.

3Cg—48 to 56 inches; grayish brown (10YR 5/2) very gravelly loamy coarse sand; single grained; loose; about 40 percent gravel; strong effervescence; moderately alkaline; abrupt wavy boundary.

4C—56 to 70 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The silty material is 10 to 20 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 3 or 4. It is medium acid or slightly acid. The 2Bt horizon has hue of 10YR, value of 4, and chroma of 2 to 4. It is clay loam, sandy clay loam, or sandy loam. The 3Bt horizon has hue of 10YR, value of 4, and chroma of 2 to 4. It is gravelly sandy clay loam, gravelly sandy loam, or gravelly clay loam. It is neutral or mildly alkaline. The 4C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Sloan Series

The Sloan series consists of deep, very poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Sloan soils are similar to Beaucoup and Cohoctah soils. Beaucoup soils have more silt and less sand in the solum than the Sloan soils, and Cohoctah soils have more sand and less clay in the profile.

Typical pedon of Sloan silt loam, rarely flooded, in a cultivated field; 690 feet south and 2,530 feet east of the northwest corner of sec. 35, T. 26 N., R. 1 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; common fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

A—9 to 12 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate coarse granular structure; friable; common fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bg1—12 to 17 inches; dark gray (10YR 4/1) loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bg2—17 to 23 inches; dark gray (10YR 4/1) loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bg3—23 to 30 inches; gray (10YR 5/1) loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate coarse subangular blocky structure; friable; few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bg4—30 to 33 inches; gray (10YR 5/1) loam; few fine distinct yellowish brown (10YR 5/8) mottles; moderate coarse subangular blocky structure; friable; about 2 percent gravel; mildly alkaline; clear wavy boundary.

BCg—33 to 37 inches; gray (10YR 5/1) loam; common fine distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; about 1 percent gravel; mildly alkaline; clear wavy boundary.

Cg1—37 to 42 inches; gray (10YR 5/1) loam; many medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; about 3 percent gravel; mildly alkaline; clear wavy boundary.

Cg2—42 to 50 inches; gray (10YR 5/1) loam; many fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; about 3 percent gravel; mildly alkaline; clear wavy boundary.

Cg3—50 to 57 inches; gray (10YR 5/1) loam; many fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; about 2 percent gravel; mildly alkaline; clear wavy boundary.

Cg4—57 to 70 inches; gray (10YR 5/1) loam; strata of silt loam and fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; about 2 percent gravel; mildly alkaline.

The solum is 30 to 50 inches thick. The Ap horizon

has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam, clay loam, and silty clay loam. The Bg horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is loam, silt loam, clay loam, or silty clay loam. It is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The Cg horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is loam, silty clay loam, or sandy loam. It is neutral to moderately alkaline. A bedrock substratum, occasionally flooded, phase of this series is mapped in the county.

Starks Series

The Starks series consists of deep, somewhat poorly drained, moderately permeable soils on till plains and outwash plains. These soils formed in silty material and in the underlying glacial outwash. Slopes range from 0 to 3 percent.

Starks soils are commonly near Camden, Cyclone, Fincastle, Patton, Rockfield, and Williamstown soils. Camden, Rockfield, and Williamstown soils are browner in the subsoil than the Starks soils. Also, they are higher on the landscape. Fincastle soils are underlain by calcareous glacial till. They are in slightly higher positions on the landscape than the Starks soils. Cyclone and Patton soils have a dark surface soil. They are in the lower positions on the landscape.

Typical pedon of Starks silt loam, in a cultivated area of Fincastle-Starks silt loams, 0 to 1 percent slopes; 1,950 feet east and 2,100 feet north of the southwest corner of sec. 19, T. 24 N., R. 1 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; strongly acid; abrupt smooth boundary.

Bt1—10 to 16 inches; brown (10YR 4/3) silty clay loam; common fine faint light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—16 to 22 inches; brown (10YR 4/3) silty clay loam; common fine faint light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; common black (N 2/0) stains and accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt3—22 to 28 inches; brown (10YR 4/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) and many medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (N 2/0) stains and accumulations of iron and manganese oxide; slightly acid; clear wavy boundary.

Bt4—28 to 35 inches; brown (10YR 4/3) silt loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (N 2/0) stains and accumulations of iron and manganese oxide; neutral; clear wavy boundary.

2Bt5—35 to 41 inches; brown (10YR 4/3) loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; mildly alkaline; neutral; clear wavy boundary.

2BCt—41 to 46 inches; brown (10YR 4/3) fine sandy loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 1 percent gravel; mildly alkaline; clear wavy boundary.

2C1—46 to 50 inches; brown (10YR 4/3) silt loam; strata of loamy sand; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; massive; friable; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—50 to 60 inches; brown (10YR 4/3) loam; thin strata of loamy fine sand; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; massive; friable; about 1 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to more than 60 inches thick. The silty material is 24 to 40 inches thick. The Ap horizon has chroma of 2 or 3. The Bt horizon has chroma of 3 or 4. It is very strongly acid to neutral. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, or clay loam. It is medium acid

to neutral. The 2C horizon has value of 4 or 5. It has strata of loam, silt loam, sandy loam, or fine sandy loam crossbedded with strata of loamy sand or loamy fine sand.

Stonelick Series

The Stonelick series consists of deep, well drained, moderately rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Stonelick soils are commonly near Armiesburg and Jules soils. Armiesburg soils have a darker surface soil than the Stonelick soils. Also, they are higher on the landscape. Jules soils have less clay and more silt in the profile than the Stonelick soils. Also, they are lower on the landscape.

Typical pedon of Stonelick fine sandy loam, in a cultivated area of Jules-Stonelick complex, frequently flooded; 4,300 feet northeast of the northwest corner and 5,500 feet southeast of the northwest boundary of the J.W. and H. Connor Reserve, T. 26 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; about 1 percent gravel; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—9 to 16 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; many fine roots; about 1 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C2—16 to 24 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C3—24 to 31 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; about 1 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C4—31 to 45 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak coarse subangular blocky structure; friable; few fine roots; about 1 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C5—45 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; about 1 percent gravel; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam and silt loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It generally is sandy loam, fine sandy loam, or loam, but below a depth of 40 inches the range includes loamy sand.

Treaty Series

The Treaty series consists of deep, poorly drained soils in depressional areas on till plains and moraines. These soils formed in silty material and in the underlying glacial till. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 2 percent.

Treaty soils are similar to Cyclone, Patton, and Pella soils and are commonly near Crosier, Mahalasville, and Whitaker soils. Whitaker soils are those that have a till substratum. Cyclone and Patton soils have thicker deposits of silty material than the Treaty soils. Pella soils have carbonates within a depth of 40 inches. Crosier and Whitaker soils do not have a dark surface layer. They are in the higher positions on the landscape. Mahalasville soils have stratified underlying material. They are in the lower positions on the landscape.

Typical pedon of Treaty silt loam, in a cultivated area of Mahalasville-Treaty silt loams; 910 feet east and 200 feet south of the northwest corner of sec. 6, T. 26 N., R. 2 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Btg1—10 to 14 inches; dark gray (10YR 4/1) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg2—14 to 18 inches; dark gray (10YR 4/1) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; neutral; clear wavy boundary.

Btg3—18 to 30 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous

very dark grayish brown (10YR 3/2) clay films on faces of peds; neutral; clear wavy boundary.

2Btg4—30 to 36 inches; dark grayish brown (2.5Y 4/2) clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2Btg5—36 to 48 inches; dark grayish brown (2.5Y 4/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2BCt—48 to 52 inches; brown (10YR 5/3) loam; many medium distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent gravel; mildly alkaline; clear wavy boundary.

2C—52 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 43 to 60 inches thick. The silty material is 24 to 40 inches thick. The mollic epipedon is 10 to 16 inches thick. The A horizon has chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is neutral or mildly alkaline. The 2C horizon has chroma of 3 or 4.

Wallkill Series

The Wallkill series consists of deep, very poorly drained soils in potholes on till plains, outwash plains, terraces, and moraines. These soils formed in mineral sediments over organic deposits. Permeability is moderate in the mineral material and moderately rapid or rapid in the organic material. Slopes range from 0 to 2 percent.

Wallkill soils are commonly near Houghton, Milford, and Palms soils. Houghton and Palms soils have less than 16 inches of mineral sediments on the surface. They are in the lower positions on the landscape. Milford soils are deep, mineral soils. They are in the higher positions on the landscape.

Typical pedon of Wallkill silt loam, in an idle area; 400 feet north and 2,500 feet west of the southeast corner of sec. 10, T. 24 N., R. 1 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bg1—9 to 23 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bg2—23 to 28 inches; dark gray (10YR 4/1) silt loam; weak medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

2Oa1—28 to 39 inches; black (N 2/0), broken face and rubbed, sapric material; 5 percent fiber, 1 percent rubbed; moderate coarse subangular blocky structure; friable; neutral; gradual wavy boundary.

2Oa2—39 to 60 inches; black (N 2/0), broken face and rubbed, sapric material; 10 percent fiber, 1 percent rubbed; moderate coarse subangular blocky structure; neutral.

The mineral material is 16 to 40 inches thick over the organic material. The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The Bg horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. It is mottled in some pedons. This horizon is silt loam, silty clay loam, or loam. It is slightly acid or neutral. The 2Oa horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly sapric material, but the range includes hemic material. It is slightly acid or neutral.

Warners Variant

The Warners Variant consists of deep, very poorly drained, moderately slowly permeable soils on foot slopes below terraces and outwash plains. These soils formed in silty material and marl. Slopes range from 2 to 8 percent.

Warners Variant soils are commonly near Plankeshaw Variant soils. Plankeshaw Variant soils have more sand and coarse fragments throughout the profile than the Warners Variant soils. Also, they are higher on the landscape.

Typical pedon of Warners Variant silt loam, 2 to 8 percent slopes, undrained, in a pasture; 150 feet east and 1,075 feet south of the northwest corner of sec. 19, T. 25 N., R. 1 W.

A—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; few shell fragments; many fine roots; strong

effervescence; moderately alkaline; clear wavy boundary.

C1—8 to 14 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; massive; friable; few shell fragments; many fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

C2—14 to 20 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; massive; friable; common shell fragments; common fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

Cg1—20 to 30 inches; dark grayish brown (2.5Y 4/2) silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; massive; friable; many shell fragments; few fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

Cg2—30 to 60 inches; grayish brown (2.5Y 5/2) marl; common medium faint light brownish gray (10YR 6/2) mottles; massive; friable; few shell fragments; violent effervescence; moderately alkaline.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2.

Washtenaw Series

The Washtenaw series consists of deep, poorly drained soils in depressions on till plains. These soils formed in silty material and in the underlying glacial drift. Permeability is moderate in the alluvium and slow in the lower part of the profile. Slopes range from 0 to 2 percent.

The Washtenaw soils in this county have less sand in the profile than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Washtenaw soils are commonly near Cyclone and Martinsville soils. Cyclone soils have a dark surface layer. They are in the slightly higher positions on the landscape. Martinsville soils are less gray in the subsoil than the Washtenaw soils. Also, they are higher on the landscape.

Typical pedon of Washtenaw silt loam, in a cultivated field; 1,355 feet east and 260 feet north of the southwest corner of sec. 3, T. 23 N., R. 1 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—9 to 13 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; slightly acid; clear wavy boundary.

Cg1—13 to 22 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; friable; common fine roots; slightly acid; clear wavy boundary.

Cg2—22 to 27 inches; dark gray (10YR 4/1) silt loam; weak fine subangular blocky structure; friable; few fine roots; about 1 percent gravel; slightly acid; clear wavy boundary.

2Ab—27 to 36 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; few fine distinct reddish brown (5YR 4/4) mottles; moderate fine subangular blocky structure; firm; few fine roots; slightly acid; clear wavy boundary.

2Bgb1—36 to 41 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; slightly acid; clear wavy boundary.

2Bgb2—41 to 46 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; slightly acid; clear wavy boundary.

2Bgb3—46 to 58 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine prominent yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; slightly acid; clear wavy boundary.

2Bgb4—58 to 67 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; slightly acid; clear wavy boundary.

2Bgb5—67 to 74 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; about 1 percent gravel; slightly acid; clear wavy boundary.

2Bgb6—74 to 80 inches; grayish brown (2.5Y 5/2) loam; weak coarse subangular blocky structure; firm; about 2 percent gravel; slightly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. The 2Ab horizon has chroma of 1 or 2. It is silty clay loam or clay loam. The 2Bgb horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam, clay loam, or loam.

Waynetown Series

The Waynetown series consists of deep, somewhat poorly drained soils on outwash plains. These soils formed in silty material and in the underlying glacial outwash. Generally, permeability is moderate in the subsoil and very rapid in the underlying material. In the till substratum phase, however, it is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 2 percent.

Waynetown soils are commonly near Mahalasville, Ockley, Rush, and Sleeth soils. Mahalasville soils have a dark surface layer. They are in the lower positions on the landscape. Ockley and Rush soils are brown in the subsoil and do not have gray mottles. They are in the higher positions on the landscape. Sleeth soils formed in a thinner deposit of silty material than the Waynetown soils. Also, they are slightly higher on the landscape.

Typical pedon of Waynetown silt loam, 0 to 2 percent slopes, in a cultivated field; 1,050 feet west and 700 feet south of the northeast corner of sec. 23, T. 25 N., R. 1 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—9 to 15 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; many fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—15 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

Bt3—21 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

Bt4—26 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

2Bt5—32 to 37 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

3Bt6—37 to 42 inches; dark yellowish brown (10YR 4/4) gravelly sandy clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 25 percent gravel; neutral; clear wavy boundary.

3Bt7—42 to 48 inches; brown (10YR 4/3) gravelly sandy clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 30 percent gravel; neutral; clear wavy boundary.

3BCt—48 to 54 inches; brown (10YR 5/3) gravelly sandy loam; common fine faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few discontinuous grayish brown (10YR 5/2) clay films on faces of peds; about 30 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

3C—54 to 60 inches; grayish brown (10YR 5/2) very gravelly loamy coarse sand; single grained; loose; about 40 percent gravel; strong effervescence; moderately alkaline.

The solum is 50 to 60 inches thick. The silty material is 24 to 38 inches thick. The Ap horizon has chroma of 2 or 3. The Bt horizon has chroma of 3 or 4. The 2Bt horizon has chroma of 2 to 4. It is medium acid or slightly acid. The 3Bt horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 2 to 4. It is gravelly clay loam, gravelly loam, gravelly sandy clay loam, or gravelly sandy loam. The 3C horizon has chroma of 2 or 3. It is very gravelly loamy coarse sand or gravelly loamy coarse sand. A till substratum phase of this series is mapped in the county.

Westland Series

The Westland series consists of deep, very poorly drained soils on terraces. These soils formed in loamy outwash over very gravelly coarse sand. Generally, permeability is moderate in the subsoil and very rapid in the underlying material. In the shale substratum phase, however, it is moderate. Slopes range from 0 to 2 percent.

Westland soils are commonly near Mudlavia and Ockley soils. Mudlavia and Ockley soils have a brown subsoil without gray mottles and do not have a dark surface layer. They are in the higher positions on the landscape.

Typical pedon of Westland loam, in a cultivated field; 1,600 feet west of the northeast corner and 2,275 feet south of the north boundary of the A. Bondie Reserve, T. 25 N., R. 2 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; about 4 percent gravel; slightly acid; abrupt smooth boundary.

AB—10 to 16 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; firm; few fine roots; thin continuous black (10YR 2/1) organic coatings on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

Btg1—16 to 23 inches; dark gray (10YR 4/1) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous black (10YR 2/1) clay films on faces of peds; neutral; clear wavy boundary.

Btg2—23 to 31 inches; dark grayish brown (2.5Y 4/2) clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

Btg3—31 to 38 inches; grayish brown (2.5Y 5/2) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 12 percent gravel; neutral; clear wavy boundary.

Btg4—38 to 44 inches; grayish brown (2.5Y 5/2) clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 14 percent gravel; neutral; clear wavy boundary.

2Btg5—44 to 51 inches; grayish brown (2.5Y 5/2) gravelly sandy clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 25 percent gravel; mildly alkaline; clear irregular boundary.

2Cg—51 to 60 inches; grayish brown (10YR 5/2) very gravelly coarse sand; single grained; loose; about 40 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is slightly acid or neutral. The 2Btg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is gravelly clay loam, gravelly sandy clay loam, gravelly loam, or gravelly sandy loam. It is mildly alkaline or moderately alkaline. Some pedons do not have a 2Btg horizon. A shale substratum phase of this series is mapped in the county.

Whitaker Series

The Whitaker series consists of deep, somewhat poorly drained soils on till plains. These soils formed in silty material and in glacial outwash over the underlying glacial till. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 1 to 3 percent.

Whitaker soils are commonly near Crosier, Mahalasville, Miami, Riddles, and Treaty soils. Crosier soils are more shallow to calcareous glacial till than the Whitaker soils. Also, they are slightly higher on the landscape. Mahalasville and Treaty soils have a dark surface soil. They are in the lower positions on the landscape. Miami and Riddles soils are not gray in the solum. They are in the higher positions on the landscape.

Typical pedon of Whitaker silt loam, till substratum, in a cultivated area of Crosier-Whitaker, till substratum, complex, 1 to 3 percent slopes; 120 feet west and 3,245 feet south of the northeast corner of sec. 3, T. 26 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam,

pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—14 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear wavy boundary.

2Bt3—20 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; slightly acid; clear wavy boundary.

2Bt4—32 to 41 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

2Bt5—41 to 49 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

2BC—49 to 53 inches; dark yellowish brown (10YR 4/4) loamy sand; strata of sandy loam; few fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; about 2 percent gravel; mildly alkaline; clear wavy boundary.

3C—53 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The silty material is 0 to 24 inches thick. The Ap horizon has chroma of 2 or 3. The Bt horizon has chroma of 2 to 4. It is medium acid or slightly acid. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, sandy clay loam, or clay loam. It is medium acid to neutral. The 2BC horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is stratified loam, sandy loam, and loamy sand. It is neutral or mildly alkaline.

Williamstown Series

The Williamstown series consists of deep, moderately well drained soils on till plains. These soils formed in silty material and in the underlying glacial till. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 1 to 6 percent.

Williamstown soils are commonly near Fincastle, Rockfield, and Starks soils. Fincastle and Starks soils are grayer in the subsoil than the Williamstown soils. Also, they are lower on the landscape. Rockfield soils formed in a thicker deposit of silty material than the Williamstown soils and are less sloping.

Typical pedon of Williamstown silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 225 feet east and 565 feet south of the northwest corner of sec. 10, T. 23 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; 20 percent dark yellowish brown (10YR 4/4) silty clay loam subsoil material; weak coarse granular structure; friable; common fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

Bt1—9 to 15 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint brown (10YR 5/3) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; common light gray (10YR 7/1) silt coatings; about 1 percent gravel; medium acid; clear wavy boundary.

2Bt2—15 to 22 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 4 percent gravel; slightly acid; clear wavy boundary.

2Bt3—22 to 30 inches; dark yellowish brown (10YR 4/4) sandy clay loam; few fine distinct grayish brown

(10YR 5/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few black (10YR 2/1) stains and accumulations of iron and manganese oxide; about 4 percent gravel; neutral; clear wavy boundary.

2BCt—30 to 34 inches; brown (10YR 4/3) fine sandy loam; common fine distinct yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few discontinuous brown (10YR 4/3) clay films on faces of peds; about 4 percent gravel; strong effervescence; mildly alkaline; clear wavy boundary.

2C1—34 to 53 inches; yellowish brown (10YR 5/4) loam; few fine distinct brown (10YR 5/3) mottles; massive; firm; about 4 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—53 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 4 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The silty material is 7 to 19 inches thick. The depth to carbonates is 25 to 40 inches. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam. It is strongly acid to slightly acid. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or sandy clay loam. It is strongly acid to neutral. The 2BCt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, fine sandy loam, or sandy clay loam. It is neutral or mildly alkaline. The 2C horizon has hue of 10YR, value of 5, and chroma of 3 or 4.

Formation of the Soils

In this section the major factors of soil formation and their importance to the formation of the soils in Carroll County are discussed.

Factors of Soil Formation

Soil forms through processes acting on deposited or accumulated geologic materials. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soils; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of glacial deposits and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always required for differentiation of soil horizons. A long time generally is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Carroll County were deposited by glaciers or by meltwater from the glaciers. Some of these materials were reworked and redeposited by subsequent actions of water and wind. These glaciers covered the county from about 19,000 to 20,000 years ago. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant types of parent material in Carroll County are glacial till, loess, outwash sediment, lacustrine sediment, alluvium, and organic deposits.

Glacial till is material laid down directly by glaciers with a minimum of water action. It consists of particles of different sizes that are mixed together. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Carroll County is calcareous and firm loam or sandy loam. Soils that formed in glacial till typically have a moderately fine textured subsoil and well developed structure. Examples are Miami and Fincastle soils.

Loess is silty material that has been windblown and then deposited by the wind. In Carroll County, the deposited silty material covered most areas in mostly thin layers over glacial till and outwash material.

Outwash sediment was deposited by running water from melting glaciers. The size of the particles that make up outwash sediment varies according to the speed of the stream of water that carried them. When the water slowed down, the coarser particles were deposited first. The finer particles, such as very fine sand, silt, and clay, were carried by more slowly moving water and deposited later. Outwash sediment generally consists of layers of particles of similar size, such as loamy sand, sand, gravelly sand, and other coarse particles. Fox and Ockley soils are examples of soils that formed in outwash sediment.

Lacustrine sediment was deposited from still, or ponded, glacial meltwater. Because the coarser fragments dropped out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. Lacustrine sediment is silty or clayey. In Carroll County, soils that formed in lacustrine sediment are typically moderately fine textured and fine textured. Milford soils are an example of soils that formed in lacustrine sediment.

Alluvium was deposited by floodwater of present streams in recent time. This material ranges in texture, depending on the speed of the water from which it was deposited. Alluvium deposited along a swift stream, such as Deer Creek, is coarser textured than that deposited along a slow, sluggish stream, such as the Wabash River. Jules and Stonelick soils are examples of alluvial soils.

Organic deposits are made up of accumulations of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash, in lakes, and on till plains. Grass and sedges growing around the edges of these lakes died, and their remains settled on the bottom of the lakes. Because of wetness, the plant remains did not decompose but remained around the edges of the lakes. Later, water-tolerant trees grew in the areas. As these trees died, their remains became part of the organic deposits. The lakes were eventually filled with organic material and developed into areas of muck and peat. In some areas the plant remains subsequently decomposed. In other areas the material has changed little since deposition. Houghton soils formed in organic deposits.

Plant and Animal Life

Plants have been the principal organisms influencing the soils in Carroll County; however, bacteria, fungi, earthworms, and human activities have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The remains of plants accumulate on the surface, decay, and eventually become organic matter. The plant roots provide channels for downward movement of water through the soil and add organic matter as they decay. Bacteria in the soil help to break down the organic matter into plant nutrients.

The vegetation in Carroll County was mainly deciduous forests. Differences in natural soil drainage and minor variations in parent material have affected the composition of the forest species. In general, the well drained upland soils, such as Riddles and Miami soils, were covered with walnut, ash, beech, and maple. The trees on the wet soils were mainly maple, ash, and sycamore. In a few of the wet soils, moss contributed substantially to the accumulation of organic matter. Cyclone and Pella soils formed under wet conditions and contain considerable amounts of organic matter. Because the soils of Carroll County developed under dominantly forest vegetation, they generally have a lower content of organic matter than soils in other parts of North America that developed under dominantly grass vegetation.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil, the amount of water available for weathering of minerals and for transporting soil materials, and, through its influence on soil temperature, the rate of chemical reaction in the soil. These influences are important, but they affect large areas rather than a relatively small area, such as a county.

The climate in Carroll County is cool and humid. It is presumably similar to the climate that existed when the soils formed. The soils in the county differ from soils that formed in a dry, warm climate or those that formed in a hot, moist climate. The climate is uniform throughout the county. More detailed information on the climate of Carroll County is in the section "General Nature of the County."

Relief

Relief, or topography, has markedly influenced the soils of Carroll County through its effects on natural drainage, erosion, plant cover, and soil temperature. Slopes range from 0 to 90 percent. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage. Drainage determines the color of the soil through its effect on aeration of the soil. Runoff is most rapid on the steeper slopes, but in low areas water is temporarily ponded. Water and air move freely through well drained soils, but they move slowly through very poorly drained soils. In well aerated soils the iron and aluminum compounds that give most soils their color are bright in color and are oxidized. Poorly aerated soils are a dull gray and are mottled. Ockley soils are an example of well drained, well aerated soils, and Milford soils are an example of very poorly drained, poorly aerated soils. Between the very poorly drained and the well drained soils are the poorly drained, somewhat poorly drained, and moderately well drained soils.

Time

A long time generally is required for distinct horizons to develop in the soil. The differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile

development. Some soils develop rapidly; others slowly.

The soils in Carroll County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to soil-forming factors long enough for distinct horizons to develop. Some soils that are forming in recent alluvium have not been in place long enough for distinct horizons to develop.

Jules soils are an example of young soils that formed in alluvium. They have weakly developed horizons. Ockley and Miami soils are examples of older soils in which horizon development is more pronounced.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in Carroll County. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils in the county. The content of organic matter is low in some soils and high in others. Generally, the soils that have the most organic matter, such as Cyclone and Pella soils, have a very dark gray or black surface layer.

The parent materials in which most of the soils developed initially contained generous amounts of calcium and magnesium carbonate minerals (lime). The removal of these carbonates from the upper horizons of the soil profile has been an important process in soil development. Removal of carbonates begins with their dissolution by water. Pure water, however, is not a very effective agent for dissolving calcium and magnesium carbonates. These salts are only slightly soluble in pure water, but when a weak acid solution is added to the water, the calcium and magnesium carbonates become moderately soluble and dissolve much more rapidly. The respiratory activity of living plant roots very likely was significant in the dissolution process of calcium and magnesium carbonates. Whenever living cells respire aerobically (in the presence of free oxygen), they give off carbon dioxide. Carbon dioxide dissolves in water to form a weak carbonic acid solution (the acidic component of carbonated beverages). Respiring plant roots thus produce acidic properties in soil water, and their action facilitates the dissolving of calcium and magnesium carbonates.

In a dissolved state, calcium and magnesium are in the form of ions that have a positive net electrical charge. Calcium and magnesium ions are essential elements in plant nutrition, and they can either be taken up by plant roots or carried away (leached) with moving soil water. Some of the calcium and magnesium ions were undoubtedly leached from the soil profiles. "Seep" sites along steep slopes that have deposits of recently precipitated calcium and magnesium carbonates provide evidence of leaching.

A large number of the calcium and magnesium ions that dissolved from carbonate mineral salts, instead of being lost by leaching, were likely translocated to upper horizons by a cyclical process of root uptake and ultimate release when the plant material decomposed. As vegetation decays, the positively charged calcium and magnesium ions that were part of the plant tissue move downward with water to the upper horizons of soil profiles, where they are held by the electrostatic forces of negatively charged clay particles. When attached to the negatively charged clay particles, the calcium and magnesium ions are again available for plant uptake. In fact, enough calcium is held by clay particles in the upper 36 inches of the Cyclone soil to grow 200 bushels per acre of corn for about 4,800 years.

The apparent lack of a correlation between the drainage regime and the depth to free, or undissolved, carbonates in the upland soils of Carroll County is evidence that the activity of living plants has been effective in removing calcium and magnesium minerals from soil profiles. The depth to free carbonates in very poorly drained soils, where very little leaching would be expected, is equivalent to the depth to free carbonates in well drained soils, where leaching would be expected to proceed much more rapidly. Furthermore, the Pella soil, which is in depressions in very poorly drained areas, has free carbonates at a very shallow depth, and occasionally carbonates are on the surface. This is possible because the depressions in which the Pella soil formed were filled with water to a sufficient depth to exclude the growth of emergent vegetation; therefore, the role of plants in removing calcium and magnesium carbonates in these areas was relatively insignificant. Calcium, magnesium, and carbonate ions also may move laterally in the soil with ground water from the somewhat poorly drained to well drained soils that are higher on the landscape to the poorly drained soils that are lower on the landscape.

C.C. Nikiforoff summarized this view of soil development when he stated: "Although the actual average rate of leaching of the horizon of weathering cannot be estimated with any degree of reliability at the present time, it seems fairly certain that, in short pedogenic cycles, living matter on land keeps a quantity

of mobile compounds greater than the amounts of annual loss due to leaching of these compounds. This is an essential feature of soil formation. Usually it is referred to as the accumulation of essential elements in the soil or the development of an essential (from the agronomical viewpoint) property of the soil, its productivity" *(5)*.

Clay accumulates in pores and other voids and forms films on the surface along which water moves. Translocation of silicate clay is among the more important processes in horizon differentiation. Fincastle soils are an example of soils in which translocated silicate clay has accumulated in the Bt horizon in the form of clay films.

Gleying, or the reduction and transfer of iron, has occurred in all of the very poorly drained to somewhat poorly drained soils in the county. In the naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from the upper horizons to the lower horizons or completely out of the profile. Mottles in some horizons indicate segregation of iron.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers.

Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, subsurface. Removal of excess ground water through buried drains, installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely

spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to

permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand;

shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0 002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Delphi, Indiana)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	33.9	16.3	25.1	61	-14	32	1.90	0.86	2.78	5	5.5
February----	38.7	20.2	29.5	64	-12	45	1.89	.94	2.71	5	6.0
March-------	49.8	29.4	39.6	79	4	139	2.77	1.50	3.89	7	3.0
April-------	64.1	40.2	52.2	86	21	371	3.84	2.18	5.31	8	.5
May---------	74.2	49.5	61.9	92	29	679	3.81	2.24	5.22	7	.0
June--------	83.0	58.9	71.0	97	41	930	4.20	2.42	5.77	7	.0
July--------	86.0	62.4	74.2	98	47	1,060	4.44	2.39	6.23	6	.0
August------	83.8	60.3	72.1	95	43	995	3.85	2.00	5.46	6	.0
September---	78.5	53.4	66.0	94	33	780	2.87	.99	4.41	5	.0
October-----	66.9	42.1	54.5	87	22	450	2.46	1.17	3.56	5	.0
November----	51.4	32.3	41.9	76	11	121	2.50	1.43	3.44	6	2.0
December----	38.8	22.9	30.9	66	-8	39	2.53	.89	3.88	6	5.9
Yearly:											
Average---	62.4	40.7	51.6	---	---	---	---	---	---	---	---
Extreme---	---	---	---	99	-17	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,641	37.06	32.10	41.82	73	22.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Delphi, Indiana)

Probability	Temperature: 24° F or lower	Temperature: 28° F or lower	Temperature: 32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 15	May 3	May 18
2 years in 10 later than--	Apr. 12	Apr. 27	May 13
5 years in 10 later than--	Apr. 4	Apr. 16	May 3
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 20	Oct. 7	Sept. 22
2 years in 10 earlier than--	Oct. 24	Oct. 13	Sept. 27
5 years in 10 earlier than--	Nov. 1	Oct. 22	Oct. 6

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Delphi, Indiana)

Probability	Daily minimum temperature during growing season: Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	192	163	139
8 years in 10	198	172	145
5 years in 10	209	188	156
2 years in 10	221	205	167
1 year in 10	226	213	173

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AsB2	Alvin fine sandy loam, 2 to 8 percent slopes, eroded	580	0.2
At	Armiesburg silty clay loam, occasionally flooded	670	0.3
Ba	Beaucoup silty clay loam, rarely flooded	1,050	0.4
Bb	Beaucoup silt loam, frequently flooded	600	0.3
CaA	Camden silt loam, 0 to 1 percent slopes	5,000	2.1
CaB2	Camden silt loam, 2 to 6 percent slopes, eroded	2,250	0.9
CeG	Casco-Hennepin loams, 30 to 70 percent slopes	2,650	1.1
Cg	Ceresco fine sandy loam, occasionally flooded	1,200	0.5
Ck	Ceresco Variant fine sandy loam, occasionally flooded	1,350	0.6
Cn	Cohoctah loam, occasionally flooded	1,150	0.5
Cp	Cohoctah loam, gravelly substratum, occasionally flooded	710	0.3
Cr	Cohoctah Variant very fine sandy loam, frequently flooded	870	0.4
CtB	Coloma loamy sand, 2 to 10 percent slopes	660	0.3
CvA	Crosby silt loam, 0 to 2 percent slopes	235	0.1
CwB	Crosby-Fincastle silt loams, 1 to 3 percent slopes	630	0.3
CyB	Crosier-Whitaker, till substratum, complex, 1 to 3 percent slopes	1,750	0.7
Cz	Cyclone silty clay loam	37,000	15.4
FaA	Fincastle-Starks silt loams, 0 to 1 percent slopes	39,250	16.3
FbB	Fincastle-Starks silt loams, 1 to 3 percent slopes	7,900	3.3
FsA	Fox sandy loam, 0 to 2 percent slopes	485	0.2
FsB2	Fox sandy loam, 2 to 6 percent slopes, eroded	375	0.2
FtC3	Fox gravelly clay loam, 6 to 15 percent slopes, severely eroded	1,200	0.5
HkG	Hennepin loam, 30 to 70 percent slopes	4,200	1.8
HnG	Hennepin-Rock outcrop complex, 30 to 90 percent slopes	425	0.2
Hw	Houghton muck, drained	960	0.4
Jr	Jules silt loam, frequently flooded	580	0.2
Js	Jules-Stonelick complex, frequently flooded	600	0.3
KcA	Kalamazoo loam, 0 to 2 percent slopes	4,650	1.9
KcB2	Kalamazoo loam, 2 to 6 percent slopes, eroded	570	0.2
KfA	Kendall silt loam, 0 to 1 percent slopes	1,600	0.7
KgA	Kendall-Fincastle silt loams, 0 to 1 percent slopes	9,700	4.0
Ld	Landes fine sandy loam, rarely flooded	1,100	0.5
Lo	Landes loam, moderately wet, occasionally flooded	880	0.4
Ls	Landes-Moundhaven complex, occasionally flooded	1,900	0.8
Ma	Mahalasville silty clay loam, gravelly substratum	710	0.3
Mb	Mahalasville silty clay loam, till substratum	7,050	2.9
Mc	Mahalasville-Treaty silt loams	900	0.4
MdB2	Martinsville, till substratum-Miami loams, 2 to 6 percent slopes, eroded	1,650	0.7
MfC3	Martinsville, till substratum-Miami clay loams, 6 to 12 percent slopes, severely eroded	4,500	1.9
MhD3	Miami clay loam, 15 to 20 percent slopes, severely eroded	1,450	0.6
MkB2	Miami-Crosier complex, 2 to 6 percent slopes, eroded	1,050	0.4
Mm	Milford silty clay loam	470	0.2
Mo	Milford silt loam, pothole	860	0.4
Mp	Milford silty clay loam, occasionally flooded	460	0.2
Mt	Millsdale loam	570	0.2
MuB	Milton Variant channery silt loam, 1 to 4 percent slopes, flaggy	940	0.4
Mv	Moundhaven-Landes Variant complex, frequently flooded	2,800	1.2
MwB	Mudlavia gravelly sandy loam, 1 to 3 percent slopes	990	0.4
MxA	Mudlavia Variant gravelly loam, 0 to 2 percent slopes	540	0.2
OdA	Ockley silt loam, 0 to 2 percent slopes	4,550	1.9
OdB2	Ockley silt loam, 2 to 6 percent slopes, eroded	3,500	1.5
OfB2	Ockley loam, till substratum, 2 to 6 percent slopes, eroded	3,700	1.5
OgA	Ockley-Rush silt loams, till substrata, 0 to 2 percent slopes	7,200	3.0
OhC3	Ockley, till substratum-Kendallville clay loams, 6 to 12 percent slopes, severely eroded	530	0.2
OrA	Ormas loamy sand, 0 to 2 percent slopes	710	0.3
OrB	Ormas loamy sand, 2 to 6 percent slopes	540	0.2
Pb	Palms muck, drained	330	0.1
Pd	Palms muck, cobbly substratum, drained	190	0.1
Pe	Palms Variant muck, drained	127	0.1
Pg	Patton silty clay loam	3,700	1.5
Pk	Pella silty clay loam	1,550	0.6
PnB	Piankeshaw Variant gravelly sandy loam, rarely flooded, 2 to 8 percent slopes	610	0.3

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
Pp	Pits, gravel	15	*
Pr	Pits, quarry	80	*
RmB2	Riddles-Miami loams, 2 to 6 percent slopes, eroded	1,850	0.8
RmD2	Riddles-Miami loams, 12 to 18 percent slopes, eroded	205	0.1
RnC3	Riddles-Miami complex, 6 to 12 percent slopes, severely eroded	1,280	0.5
RoA	Rockfield silt loam, 0 to 2 percent slopes	5,100	2.1
RrB2	Rockfield-Williamstown complex, 1 to 6 percent slopes, eroded	14,600	6.1
Rt	Ross fine sandy loam, protected	760	0.3
Ru	Ross loam, rarely flooded	285	0.1
RwA	Rush silt loam, 0 to 2 percent slopes	1,950	0.8
Sn	Sloan silt loam, rarely flooded	660	0.3
So	Sloan silt loam, occasionally flooded	1,050	0.4
Ss	Sloan silt loam, bedrock substratum, occasionally flooded	290	0.1
StA	Starks silt loam, 0 to 1 percent slopes	6,500	2.7
Ud	Udorthents, loamy	750	0.3
Wd	Wallkill silt loam	690	0.3
We	Warners Variant silt loam, 2 to 8 percent slopes, undrained	190	0.1
Wk	Washtenaw silt loam	550	0.2
WoA	Waynetown silt loam, 0 to 2 percent slopes	1,200	0.5
WpA	Waynetown-Sleeth silt loams, till substrata, 0 to 1 percent slopes	9,100	3.8
Wr	Westland loam	750	0.3
Ws	Westland loam, shale substratum	250	0.1
WvB2	Williamstown silt loam, 2 to 6 percent slopes, eroded	2,200	0.9
	Water areas more than 40 acres in size	1,855	0.8
	Water areas less than 40 acres in size	926	0.4
	Total	239,993	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AsB2	Alvin fine sandy loam, 2 to 8 percent slopes, eroded
At	Armiesburg silty clay loam, occasionally flooded
Ba	Beaucoup silty clay loam, rarely flooded (where drained)
Bb	Beaucoup silt loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
CaA	Camden silt loam, 0 to 1 percent slopes
CaB2	Camden silt loam, 2 to 6 percent slopes, eroded
Cg	Ceresco fine sandy loam, occasionally flooded (where drained)
Ck	Ceresco Variant fine sandy loam, occasionally flooded (where drained)
Cn	Cohoctah loam, occasionally flooded (where drained)
Cp	Cohoctah loam, gravelly substratum, occasionally flooded (where drained)
Cr	Cohoctah Variant very fine sandy loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
CvA	Crosby silt loam, 0 to 2 percent slopes (where drained)
CwB	Crosby-Fincastle silt loams, 1 to 3 percent slopes (where drained)
CyB	Crosier-Whitaker, till substratum, complex, 1 to 3 percent slopes (where drained)
Cz	Cyclone silty clay loam (where drained)
FaA	Fincastle-Starks silt loams, 0 to 1 percent slopes (where drained)
FbB	Fincastle-Starks silt loams, 1 to 3 percent slopes (where drained)
FsA	Fox sandy loam, 0 to 2 percent slopes
FsB2	Fox sandy loam, 2 to 6 percent slopes, eroded
Js	Jules-Stonelick complex, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
KcA	Kalamazoo loam, 0 to 2 percent slopes
KcB2	Kalamazoo loam, 2 to 6 percent slopes, eroded
KfA	Kendall silt loam, 0 to 1 percent slopes (where drained)
KgA	Kendall-Fincastle silt loams, 0 to 1 percent slopes (where drained)
Ld	Landes fine sandy loam, rarely flooded
Lo	Landes loam, moderately wet, occasionally flooded
Ls	Landes-Moundhaven complex, occasionally flooded
Ma	Mahalasville silty clay loam, gravelly substratum (where drained)
Mb	Mahalasville silty clay loam, till substratum (where drained)
Mc	Mahalasville-Treaty silt loams (where drained)
MdB2	Martinsville, till substratum-Miami loams, 2 to 6 percent slopes, eroded
MkB2	Miami-Crosier complex, 2 to 6 percent slopes, eroded
Mm	Milford silty clay loam (where drained)
Mp	Milford silty clay loam, occasionally flooded (where drained)
Mt	Millsdale loam (where drained)
OdA	Ockley silt loam, 0 to 2 percent slopes
OdB2	Ockley silt loam, 2 to 6 percent slopes, eroded
OfB2	Ockley loam, till substratum, 2 to 6 percent slopes, eroded
OgA	Ockley-Rush silt loams, till substrata, 0 to 2 percent slopes
Pg	Patton silty clay loam (where drained)
Pk	Pella silty clay loam (where drained)
RmB2	Riddles-Miami loams, 2 to 6 percent slopes, eroded
RoA	Rockfield silt loam, 0 to 2 percent slopes
RrB2	Rockfield-Williamstown complex, 1 to 6 percent slopes, eroded
Rt	Ross fine sandy loam, protected
Ru	Ross loam, rarely flooded
RwA	Rush silt loam, 0 to 2 percent slopes
Sn	Sloan silt loam, rarely flooded (where drained)
So	Sloan silt loam, occasionally flooded (where drained)
Ss	Sloan silt loam, bedrock substratum, occasionally flooded (where drained)
StA	Starks silt loam, 0 to 1 percent slopes (where drained)
Wk	Washtenaw silt loam (where drained)
WoA	Waynetown silt loam, 0 to 2 percent slopes (where drained)
WpA	Waynetown-Sleeth silt loams, till substrata, 0 to 1 percent slopes (where drained)
Wr	Westland loam (where drained)
Ws	Westland loam, shale substratum (where drained)
WvB2	Williamstown silt loam, 2 to 6 percent slopes, eroded

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
AsB2----------------------- Alvin	IIe	94	32	46	4.1	8.2
At------------------------- Armiesburg	IIw	110	42	47	3.8	8.8
Ba------------------------- Beaucoup	IIw	138	46	55	4.6	9.2
Bb------------------------- Beaucoup	IVw	90	30	---	3.0	6.0
CaA------------------------ Camden	I	125	44	50	4.1	8.2
CaB2----------------------- Camden	IIe	120	40	48	4.0	8.0
CeG------------------------ Casco-Hennepin	VIIe	---	---	---	---	---
Cg------------------------- Ceresco	IIw	115	40	---	3.8	7.2
Ck------------------------- Ceresco Variant	IIw	105	37	---	3.5	7.0
Cn------------------------- Cohoctah	IIw	125	45	---	4.1	8.2
Cp------------------------- Cohoctah	IIw	125	43	---	4.1	8.2
Cr------------------------- Cohoctah Variant	IIIw	125	44	---	4.1	8.2
CtB------------------------ Coloma	IVs	45	18	20	1.4	2.8
CvA------------------------ Crosby	IIw	110	40	50	3.4	6.8
CwB------------------------ Crosby-Fincastle	IIe	118	42	50	3.9	7.7
CyB------------------------ Crosier-Whitaker	IIe	120	42	51	4.0	8.0
Cz------------------------- Cyclone	IIw	155	54	62	5.1	10.2
FaA------------------------ Fincastle-Starks	IIw	130	44	53	4.3	8.6
FbB------------------------ Fincastle-Starks	IIe	129	44	52	4.3	8.6

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
FsA: Fox	IIs	95	32	38	3.1	6.2
FsB2: Fox	IIe	92	29	40	3.0	6.0
FtC3: Fox	IVe	75	25	30	2.5	5.0
HkG: Hennepin	VIIe	---	---	---	---	---
HnG: Hennepin-Rock outcrop	VIIe	---	---	---	---	---
Hw: Houghton	IIIw	118	34	---	---	---
Jr: Jules	Vw	---	---	---	---	---
Js: Jules-Stonelick	IIw	82	28	---	2.7	5.4
KcA: Kalamazoo	IIs	100	35	40	3.3	6.6
KcB2: Kalamazoo	IIe	95	33	38	3.1	6.2
KfA: Kendall	IIw	135	41	55	4.5	9.0
KgA: Kendall-Fincastle	IIw	134	43	55	4.4	8.8
Ld: Landes	IIs	99	34	40	3.3	6.6
Lo: Landes	IIw	75	26	---	2.5	5.0
Ls: Landes-Moundhaven	IIw	67	24	---	2.2	4.4
Ma: Mahalasville	IIw	155	54	62	5.1	10.2
Mb: Mahalasville	IIw	150	52	60	5.0	10.0
Mc: Mahalasville-Treaty	IIw	153	53	61	5.0	9.9
MdB2: Martinsville-Miami	IIe	105	37	44	3.4	6.8
MfC3: Martinsville-Miami	IVe	87	30	36	2.9	5.8

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
MhD3---------------------- Miami	VIe	---	---	---	---	5.0
MkB2---------------------- Miami-Crosier	IIe	112	39	45	3.7	7.3
Mm------------------------ Milford	IIw	131	48	56	4.3	8.6
Mo------------------------ Milford	IVw	65	23	29	2.1	4.2
Mp------------------------ Milford	IIw	126	44	---	4.2	8.4
Mt------------------------ Millsdale	IIIw	112	44	50	3.7	7.4
MuB----------------------- Milton Variant	IVs	25	9	10	1.0	2.0
Mv------------------------ Moundhaven-Landes Variant	IIIw	66	22	---	2.2	4.2
MwB----------------------- Mudlavia	IVe	70	25	28	2.3	4.6
MxA----------------------- Mudlavia Variant	IIIs	45	16	20	1.5	3.0
OdA----------------------- Ockley	I	110	38	44	3.6	7.2
OdB2---------------------- Ockley	IIe	105	37	42	3.4	6.8
OfB2---------------------- Ockley	IIe	100	35	42	3.3	6.6
OgA----------------------- Ockley-Rush	I	120	42	48	4.0	7.9
OhC3---------------------- Ockley-Kendallville	IVe	84	29	34	2.9	5.8
OrA----------------------- Ormas	IIIs	80	28	32	2.6	5.2
OrB----------------------- Ormas	IIIe	80	28	32	2.6	5.2
Pb------------------------ Palms	IIIw	118	42	---	---	---
Pd------------------------ Palms	IIIw	125	44	---	---	8.2
Pe------------------------ Palms Variant	IIIw	105	37	---	---	7.0
Pg------------------------ Patton	IIw	148	52	59	4.9	9.8

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Pk---------------------- Pella	IIw	140	48	56	4.6	9.2
PnB--------------------- Piankeshaw Variant	IVs	75	26	30	2.5	5.0
Pp, Pr. Pits						
RmB2-------------------- Riddles-Miami	IIe	105	37	42	3.5	6.9
RmD2-------------------- Riddles-Miami	IVe	83	30	33	2.7	5.4
RnC3-------------------- Riddles-Miami	IVe	90	32	36	3.0	6.0
RoA--------------------- Rockfield	I	120	42	48	4.0	8.0
RrB2-------------------- Rockfield-Williamstown	IIe	114	39	47	3.8	7.5
Rt, Ru------------------ Ross	I	140	46	56	4.6	9.2
RwA--------------------- Rush	I	125	44	50	4.1	8.2
Sn---------------------- Sloan	IIIw	140	49	56	4.6	9.2
So---------------------- Sloan	IIIw	135	47	---	4.5	9.0
Ss---------------------- Sloan	IIIw	125	44	---	4.1	8.2
StA--------------------- Starks	IIw	129	45	52	4.3	8.6
Ud. Udorthents						
Wd---------------------- Wallkill	IIIw	130	45	55	4.5	9.0
We---------------------- Warners Variant	Vw	---	---	---	---	---
Wk---------------------- Washtenaw	IIw	130	46	52	4.3	8.6
WoA--------------------- Waynetown	IIw	125	45	50	4.0	8.0
WpA--------------------- Waynetown-Sleeth	IIw	128	45	52	4.2	8.4

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Wr------------------------ Westland	IIw	140	49	56	4.6	9.2
Ws------------------------ Westland	IIw	130	46	52	4.3	8.6
WvB2---------------------- Williamstown	IIe	110	38	50	3.6	7.2

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	24,845	---	---	---
II	179,615	42,230	130,775	6,610
III	10,897	540	9,107	1,250
IV	11,515	8,705	600	2,210
V	770	---	770	---
VI	1,450	1,450	---	---
VII	7,275	7,275	---	---
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
AsB2: Alvin	4A	Slight	Slight	Slight	Slight	White oak	80	62	Green ash, black walnut, yellow poplar, white oak, eastern white pine, American sycamore, sugar maple.
						Northern red oak	80	62	
						Black walnut	---	---	
						Yellow poplar	90	90	
At: Armiesburg	8A	Slight	Slight	Slight	Slight	Yellow poplar	100	107	Eastern white pine, black walnut, yellow poplar, black locust.
						White oak	90	72	
						Black walnut	70	---	
Ba, Bb: Beaucoup	5W	Slight	Severe	Moderate	Moderate	Pin oak	90	72	Eastern cottonwood, red maple, American sycamore, pin oak.
						Eastern cottonwood	100	128	
						Cherrybark oak	---	---	
						American sycamore	---	---	
CaA, CaB2: Camden	7A	Slight	Slight	Slight	Slight	Yellow poplar	95	98	White oak, black walnut, green ash, eastern white pine, red pine, yellow poplar, black locust, white ash.
						White oak	85	67	
						Northern red oak	85	67	
						Green ash	76	75	
CeG:									
Casco	4R	Severe	Severe	Moderate	Slight	Northern red oak	55	38	Eastern redcedar, eastern white pine, northern white-cedar.
						Black oak	---	---	
						White oak	---	---	
Hennepin	5R	Severe	Severe	Slight	Slight	Northern red oak	85	67	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine, eastern redcedar.
						White oak	---	---	
Cg: Ceresco	4W	Slight	Moderate	Slight	Slight	Northern red oak	76	58	Eastern white pine, yellow poplar, red maple, white ash, red pine.
						White ash	---	---	
						Red maple	---	---	
						Bur oak	---	---	
						Green ash	---	---	
						Quaking aspen	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
Ck------------- Ceresco Variant	4W	Slight	Moderate	Slight	Slight	Northern red oak---- Eastern cottonwood-- American sycamore--- White ash-----------	76 --- --- ---	58 --- --- ---	Pin oak, yellow poplar, white ash.
Cn-------------- Cohoctah	3W	Slight	Severe	Moderate	Moderate	Red maple----------- Silver maple-------- Pin oak------------- Green ash----------- Eastern cottonwood-- Black cherry-------- Swamp white oak-----	72 95 --- 70 --- --- ---	44 46 --- 66 --- --- ---	Eastern cottonwood, pin oak, green ash, red maple, American sycamore, swamp white oak.
Cp-------------- Cohoctah	2W	Slight	Severe	Severe	Severe	Silver maple-------- Red maple----------- Eastern cottonwood-- White ash----------- Swamp white oak----- American sycamore---	80 56 --- --- --- ---	34 36 --- --- --- ---	Eastern white pine, white spruce, northern white-cedar.
Cr-------------- Cohoctah Variant	3W	Slight	Severe	Severe	Severe	Red maple----------- Pin oak------------- Green ash----------- American sycamore---	72 86 --- ---	44 68 --- ---	Eastern cottonwood, pin oak, American sycamore.
CtB------------- Coloma	4S	Slight	Moderate	Moderate	Slight	Northern red oak---- White oak-----------	70 70	52 52	Eastern white pine, red pine, jack pine.
CvA------------- Crosby	4A	Slight	Slight	Slight	Slight	White oak----------- Pin oak------------- Yellow poplar------- Northern red oak----	75 85 85 75	57 67 81 57	Eastern white pine, northern red oak, white ash, red maple, yellow poplar, American sycamore.
CwB:									
Crosby---------	4A	Slight	Slight	Slight	Slight	White oak----------- Pin oak------------- Yellow poplar------- Northern red oak----	75 85 85 75	57 67 81 57	Eastern white pine, northern red oak, white ash, red maple, yellow poplar, American sycamore.
Fincastle------	4A	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Pin oak------------- Yellow poplar-------	75 75 85 85	57 57 67 81	Eastern white pine, white ash, red maple, yellow poplar, American sycamore.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
CyB:									
Crosier	4A	Slight	Slight	Slight	Slight	White oak	75	57	Eastern white pine, white ash, red maple, yellow poplar, American sycamore.
						Pin oak	85	67	
						Yellow poplar	85	81	
						Northern red oak	75	57	
Whitaker	4A	Slight	Slight	Slight	Slight	White oak	70	52	Eastern white pine, white ash, red maple, yellow poplar, American sycamore.
						Pin oak	85	67	
						Yellow poplar	85	81	
						Northern red oak	80	57	
Cz Cyclone	5W	Slight	Severe	Severe	Severe	Pin oak	90	72	Eastern white pine, red maple, white ash, sweetgum.
						White oak	75	57	
FaA, FbB:									
Fincastle	4A	Slight	Slight	Slight	Slight	Northern red oak	75	57	Eastern white pine, white ash, red maple, yellow poplar, American sycamore.
						White oak	75	57	
						Pin oak	85	67	
						Yellow poplar	85	81	
Starks	4A	Slight	Slight	Slight	Slight	White oak	80	62	Sugar maple, American sycamore, yellow poplar, white oak, green ash.
						Northern red oak	80	62	
						Yellow poplar	90	90	
						Black walnut	---	---	
FsA, FsB2 Fox	4A	Slight	Slight	Slight	Slight	Northern red oak	80	62	Yellow poplar, white ash, eastern white pine, red pine.
						White oak	---	---	
						Sugar maple	---	---	
FtC3 Fox	4A	Slight	Slight	Slight	Slight	Northern red oak	80	62	Black walnut, white oak, yellow poplar, northern red oak, white ash, eastern white pine, red pine.
						White oak	---	---	
						Black walnut	---	---	
						Black cherry	---	---	
						Sugar maple	---	---	
						White ash	---	---	
						Yellow poplar	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
HkG------------- Hennepin	5R	Severe	Severe	Slight	Slight	Northern red oak----	85	67	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine.
						White oak-----------	---	---	
HnG:									
Hennepin-------	5R	Severe	Severe	Slight	Slight	Northern red oak----	85	67	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine.
						White oak-----------	---	---	
Rock outcrop.									
Hw-------------- Houghton	2W	Slight	Severe	Severe	Severe	White ash-----------	51	35	
						Red maple-----------	51	33	
						Black willow--------	---	---	
						Quaking aspen-------	56	56	
						Silver maple--------	76	30	
Js: Jules.									
Stonelick------	4A	Slight	Slight	Slight	Slight	Northern red oak----	80	62	Eastern white pine, black walnut, yellow poplar, white ash, red pine, white oak.
						Yellow poplar-------	95	98	
						White oak-----------	---	---	
						Black walnut--------	---	---	
						Black cherry--------	---	---	
						Sugar maple---------	---	---	
						White ash-----------	---	---	
KcA, KcB2------- Kalamazoo	4A	Slight	Slight	Slight	Slight	Northern red oak----	65	48	Black walnut, yellow poplar, eastern white pine, white spruce, red pine, Carolina poplar.
						White ash-----------	65	59	
						Black walnut--------	65	---	
						Yellow poplar-------	65	45	
						White oak-----------	---	---	
						Black cherry--------	---	---	
						American basswood---	65	59	
						Sugar maple---------	61	38	
KfA------------- Kendall	4A	Slight	Slight	Slight	Slight	White oak-----------	80	62	White oak, black walnut, northern red oak, green ash, eastern white pine, red pine.
						Northern red oak----	80	62	
						Yellow poplar-------	90	90	
						Black walnut--------	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
KgA:									
Kendall	4A	Slight	Slight	Slight	Slight	White oak	80	62	White oak, black walnut, northern red oak, green ash, eastern white pine, red pine.
						Northern red oak	80	62	
						Yellow poplar	90	90	
						Black walnut	---	---	
Fincastle	4A	Slight	Slight	Slight	Slight	Northern red oak	75	57	Eastern white pine, white ash, red maple, yellow poplar, American sycamore.
						White oak	75	57	
						Pin oak	85	67	
						Yellow poplar	85	81	
Ld: Landes	7A	Slight	Slight	Slight	Slight	Yellow poplar	95	98	Eastern cottonwood, yellow poplar, American sycamore, green ash, black walnut, eastern white pine, sugar maple.
						Eastern cottonwood	105	141	
						American sycamore	---	---	
						Green ash	---	---	
Lo: Landes	10A	Slight	Slight	Slight	Slight	Eastern cottonwood	105	141	Sugar maple, eastern cottonwood, yellow poplar, American sycamore, green ash, black walnut, eastern white pine.
						Yellow poplar	95	98	
						American sycamore	---	---	
						Green ash	---	---	
Ls:									
Landes	7A	Slight	Slight	Slight	Slight	Yellow poplar	95	98	Eastern cottonwood, yellow poplar, American sycamore, green ash, black walnut, eastern white pine, sugar maple.
						Eastern cottonwood	105	141	
						American sycamore	---	---	
						Green ash	---	---	
Moundhaven	4S	Slight	Slight	Moderate	Severe	Northern red oak	78	60	Black walnut, black oak, yellow poplar, red pine.
						White oak	---	---	
						Yellow poplar	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
Ma-------------- Mahalasville	5W	Slight	Severe	Severe	Severe	Pin oak------------ White oak----------	85 75	67 57	Eastern white pine, red maple, white ash, silver maple.
Mb-------------- Mahalasville	5W	Slight	Severe	Severe	Severe	Pin oak------------ White oak----------	85 75	67 57	Red maple, silver maple, green ash, swamp white oak.
Mc:									
Mahalasville---	5W	Slight	Severe	Severe	Severe	Pin oak------------ White oak----------	85 75	67 57	Eastern white pine, red maple, white ash.
Treaty----------	5W	Slight	Severe	Severe	Severe	Pin oak------------ White oak---------- Northern red oak----	90 75 ---	72 57 ---	Eastern white pine, red maple, white ash.
MdB2, MfC3:									
Martinsville---	5A	Slight	Slight	Slight	Slight	White oak---------- Northern red oak---- Yellow poplar-------	90 90 98	72 72 104	Eastern white pine, white ash, yellow poplar, black walnut.
Miami-----------	5A	Slight	Slight	Slight	Slight	White oak---------- Yellow poplar-------	90 98	72 104	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
MhD3------------ Miami	5A	Slight	Slight	Slight	Slight	White oak---------- Yellow poplar-------	90 98	72 104	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
MkB2:									
Miami-----------	5A	Slight	Slight	Slight	Slight	White oak---------- Yellow poplar-------	90 98	72 104	Eastern white pine, red pine, white ash, yellow poplar, black walnut.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
MkB2:									
Crosier	4A	Slight	Slight	Slight	Slight	White oak	75	57	Eastern white pine, white ash, red maple, yellow poplar, American sycamore.
						Pin oak	85	67	
						Yellow poplar	85	81	
						Northern red oak	80	---	
Mt Millsdale	5W	Slight	Severe	Severe	Severe	Pin oak	86	68	Red maple, American sycamore, eastern cottonwood, pin oak, green ash, swamp white oak.
						Red maple	---	---	
						Eastern cottonwood	---	---	
						Black cherry	---	---	
						Green ash	---	---	
						Swamp white oak	---	---	
MuB Milton Variant	4D	Slight	Moderate	Moderate	Severe	Northern red oak	70	52	Eastern white pine, red pine, yellow poplar.
Mv:									
Moundhaven	4S	Slight	Slight	Moderate	Severe	Northern red oak	78	60	Black walnut, black oak, yellow poplar, red pine.
						White oak	---	---	
						Yellow poplar	---	---	
Landes Variant	5W	Slight	Moderate	Slight	Slight	Yellow poplar	100	107	Black walnut, eastern cottonwood.
MwB Mudlavia	4A	Slight	Slight	Slight	Slight	White oak	80	62	White oak, yellow poplar, northern red oak, white ash, green ash, eastern white pine, red pine, black cherry.
						Yellow poplar	88	86	
						Northern red oak	80	62	
						Shagbark hickory	---	---	
MxA Mudlavia Variant	4F	Slight	Moderate	Moderate	Slight	White oak	80	62	White oak, yellow poplar, northern red oak, eastern white pine, red pine, black cherry.
						Yellow poplar	88	86	
						Northern red oak	80	62	
						Shagbark hickory	---	---	
OdA, OdB2 Ockley	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Northern red oak	90	72	
						Yellow poplar	98	104	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
OfB2: Ockley	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, white ash, yellow poplar, black walnut.
						Northern red oak	90	72	
						Yellow poplar	98	80	
OgA: Ockley	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, white ash, yellow poplar, black walnut.
						Northern red oak	90	72	
						Yellow poplar	98	80	
Rush	8A	Slight	Slight	Slight	Slight	Yellow poplar	105	115	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
OhC3: Ockley	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, white ash, yellow poplar, black walnut.
						Northern red oak	90	72	
						Yellow poplar	98	105	
Kendallville	5A	Slight	Slight	Slight	Slight	Northern red oak	87	69	Eastern white pine, black walnut, red pine, yellow poplar, white ash, northern red oak, white oak.
						Yellow poplar	95	98	
						White oak	---	---	
						Black walnut	---	---	
						Black cherry	---	---	
						Sugar maple	---	---	
						White ash	---	---	
OrA, OrB: Ormas	4S	Slight	Slight	Moderate	Slight	White oak	70	52	Eastern white pine, red pine, yellow poplar, black walnut, European alder.
						Yellow poplar	---	---	
						Eastern white pine	---	---	
						Red pine	78	91	
Pb: Palms	2W	Slight	Severe	Severe	Severe	White ash	51	35	
						Red maple	51	33	
						Quaking aspen	56	56	
						Black willow	---	---	
						Silver maple	76	30	
Pd: Palms	2W	Slight	Severe	Severe	Severe	White ash	51	35	
						Silver maple	76	30	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
Pe------------- Palms Variant	2W	Slight	Severe	Severe	Severe	White ash-----------	51	35	
						Silver maple--------	76	30	
Pg------------- Patton	5W	Slight	Severe	Moderate	Moderate	Pin oak-------------	85	67	Eastern white pine, red maple, white ash, pin oak.
						White oak-----------	75	57	
						Northern red oak----	75	57	
PnB------------ Piankeshaw Variant	3F	Slight	Moderate	Severe	Slight	Sugar maple---------	60	38	Green ash, eastern white pine, yellow poplar, American sycamore.
						Black walnut--------	---	---	
						American sycamore---	---	---	
						Hackberry-----------	---	---	
RmB2:									
Riddles--------	5A	Slight	Slight	Slight	Slight	White oak-----------	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Yellow poplar-------	98	104	
						Northern red oak----	90	72	
Miami----------	5A	Slight	Slight	Slight	Slight	White oak-----------	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Yellow poplar-------	98	104	
RmD2:									
Riddles--------	5R	Moderate	Moderate	Slight	Slight	White oak-----------	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Yellow poplar-------	98	104	
						Northern red oak----	90	72	
Miami----------	5R	Moderate	Moderate	Slight	Slight	White oak-----------	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Yellow poplar-------	98	104	
RnC3:									
Riddles--------	5A	Slight	Slight	Slight	Slight	White oak-----------	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Yellow poplar-------	98	104	
						Northern red oak----	90	72	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
RnC3:									
Miami	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Yellow poplar	98	104	
RoA Rockfield	8A	Slight	Slight	Slight	Slight	Yellow poplar	105	115	Eastern white pine, yellow poplar, white oak, black walnut, green ash, white ash.
						White ash	85	88	
RrB2:									
Rockfield	8A	Slight	Slight	Slight	Slight	Yellow poplar	105	115	Eastern white pine, yellow poplar, white oak, black walnut, green ash, white ash.
						White ash	85	88	
Williamstown	5A	Slight	Slight	Slight	Slight	White oak	85	67	Black walnut, white oak, yellow poplar.
						Yellow poplar	100	107	
						White ash	85	88	
Rt, Ru Ross	5A	Slight	Slight	Slight	Slight	Northern red oak	86	68	Eastern white pine, black walnut, white ash, yellow poplar.
						Yellow poplar	96	100	
						Sugar maple	85	52	
						White oak	---	---	
						Black walnut	---	---	
						Black cherry	---	---	
						White ash	---	---	
RwA Rush	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Northern red oak	90	72	
						Yellow poplar	98	104	
Sn, So Sloan	5W	Slight	Severe	Moderate	Moderate	Pin oak	86	68	Red maple, green ash, eastern cottonwood, pin oak, swamp white oak, silver maple, American sycamore.
						Swamp white oak	---	---	
						Red maple	---	---	
						Green ash	---	---	
						Eastern cottonwood	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
Ss----------- Sloan	5W	Slight	Severe	Severe	Severe	Pin oak------------	85	67	Red maple, green ash, swamp white oak, silver maple.
						Green ash----------	---	---	
						Red maple----------	---	---	
						Swamp white oak-----	---	---	
StA----------- Starks	4A	Slight	Slight	Slight	Slight	White oak----------	80	62	Sugar maple, American sycamore, yellow poplar, white oak, green ash.
						Northern red oak----	80	62	
						Yellow poplar-------	90	90	
						Black walnut--------	---	---	
Wd----------- Wallkill	3W	Slight	Severe	Severe	Severe	Pin oak------------	65	45	Red maple, green ash, eastern cottonwood, pin oak, swamp white oak.
						Red maple----------	51	33	
						White ash----------	52	37	
						Quaking aspen-------	56	56	
						Black willow--------	---	---	
						Silver maple--------	---	---	
Wk----------- Washtenaw	5W	Slight	Severe	Severe	Moderate	Pin oak------------	86	68	Eastern white pine, black spruce, red maple, white ash, white spruce.
						Northern red oak----	75	57	
						Red maple----------	70	43	
						Silver maple--------	70	3	
						White ash----------	---	---	
						American basswood---	---	---	
						White oak----------	---	---	
WoA----------- Waynetown	5A	Slight	Slight	Slight	Slight	Pin oak------------	85	67	Eastern white pine, white ash, red maple, yellow poplar, American sycamore.
						Yellow poplar-------	85	81	
						White oak----------	75	57	
WpA:									
Waynetown------	5A	Slight	Slight	Slight	Slight	Pin oak------------	85	67	Eastern white pine, white ash, yellow poplar.
						Yellow poplar-------	85	81	
						White oak----------	75	57	
Sleeth---------	5A	Slight	Slight	Slight	Slight	Pin oak------------	85	67	Eastern white pine, white ash, yellow poplar.
						Yellow poplar-------	85	81	
						White oak----------	70	52	
Wr----------- Westland	5W	Slight	Severe	Severe	Severe	Pin oak------------	85	67	Eastern white pine, red maple, white ash.
						White oak----------	75	57	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Ws-------------- Westland	5W	Slight	Severe	Severe	Severe	Pin oak------------- White oak-----------	85 75	67 57	American sycamore, eastern cottonwood, green ash, pin oak, red maple.
WvB2------------ Williamstown	5A	Slight	Slight	Slight	Slight	White oak----------- Yellow poplar------- White ash-----------	85 100 85	67 107 88	Black walnut, white oak, yellow poplar.

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AsB2: Alvin	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, Osageorange, eastern redcedar.	Eastern white pine, red pine, Norway spruce.	---
At: Armiesburg	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
Ba, Bb: Beaucoup	---	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
CaA, CaB2: Camden	---	Amur honeysuckle, Amur privet, silky dogwood, American cranberrybush.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak, imperial Carolina poplar.
CeG:					
Casco	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn olive, Washington hawthorn, Amur honeysuckle.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
Hennepin	Siberian peashrub	Eastern redcedar, Osageorange, Russian olive, jack pine, Washington hawthorn, gray dogwood, silky dogwood, Amur privet, American cranberrybush.	Honeylocust, northern catalpa.	---	---
Cg: Ceresco	---	Silky dogwood, American cranberrybush, Amur privet, Amur honeysuckle.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine, imperial Carolina poplar.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ck----------------- Ceresco Variant	---	Siberian peashrub	Green ash, Osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow------	Imperial Carolina poplar.
Cn, Cp------------ Cohoctah	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
Cr----------------- Cohoctah Variant	---	Washington hawthorn, nannyberry viburnum.	Osageorange, green ash, eastern redcedar, northern white-cedar, white spruce.	Black willow------	Imperial Carolina poplar.
CtB---------------- Coloma	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
CvA---------------- Crosby	---	Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	Imperial Carolina poplar.
CwB:					
Crosby-----------	---	Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
CwB:					
Fincastle	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
CyB:					
Crosier	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, blue spruce, northern white-cedar, Washington hawthorn, white fir.	Norway spruce	Eastern white pine, pin oak.
Whitaker	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Cz Cyclone	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
FaA, FbB:					
Fincastle	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
Starks	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
FsA, FsB2 Fox	Siberian peashrub	Autumn olive, Amur honeysuckle, eastern redcedar, radiant crabapple, Washington hawthorn, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
FtC3---------------- Fox	Siberian peashrub	Lilac, Amur honeysuckle, autumn olive, Washington hawthorn, radiant crabapple, eastern redcedar.	Eastern white pine, jack pine, red pine, Austrian pine.	---	---
HkG---------------- Hennepin	Siberian peashrub	Eastern redcedar, Osageorange, Russian olive, jack pine, Washington hawthorn, gray dogwood, silky dogwood, Amur privet, American cranberrybush.	Honeylocust, northern catalpa.	---	---
HnG:					
Hennepin----------	Siberian peashrub	Eastern redcedar, Osageorange, Russian olive, jack pine, Washington hawthorn, gray dogwood, silky dogwood, Amur privet, American cranberrybush.	Honeylocust, northern catalpa.	---	---
Rock outcrop.					
Hw----------------- Houghton	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Jr----------------- Jules	---	Silky dogwood, Siberian peashrub.	Green ash, Osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow------	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Js:					
Jules	---	Silky dogwood, Siberian peashrub.	Green ash, Osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	Imperial Carolina poplar.
Stonelick	---	Siberian peashrub	Green ash, eastern redcedar, Osageorange, northern white-cedar, nannyberry viburnum, white spruce, Washington hawthorn.	Black willow	Imperial Carolina poplar.
KcA, KcB2 Kalamazoo	---	Lilac, American cranberrybush, Siberian peashrub, silky dogwood, nannyberry viburnum, eastern redcedar.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
KfA Kendall	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
KgA:					
Kendall	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
Fincastle	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
Ld, Lo Landes	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ls: Landes	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
Moundhaven	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, Washington hawthorn, northern white-cedar, nannyberry viburnum, Osageorange, white spruce, eastern redcedar.	---	Imperial Carolina poplar.
Ma, Mb Mahalasville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
Mc: Mahalasville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
Treaty	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
MdB2, MfC3: Martinsville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Miami	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
MhD3 Miami	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
MkB2:					
Miami	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Crosier	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, blue spruce, northern white-cedar, Washington hawthorn, white fir.	Norway spruce	Eastern white pine, pin oak.
Mm, Mo: Milford	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak, imperial Carolina poplar.
Mp: Milford	---	American cranberrybush, Amur honeysuckle, silky dogwood, Amur privet.	Washington hawthorn, Austrian pine, blue spruce, northern white-cedar, white fir, Norway spruce.	Eastern white pine	Pin oak, imperial Carolina poplar.
Mt: Millsdale	---	American cranberrybush, silky dogwood, Amur privet, Amur honeysuckle.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	---
MuB. Milton Variant					
Mv:					
Moundhaven	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, Washington hawthorn, northern white-cedar, nannyberry viburnum, Osageorange, white spruce, eastern redcedar.	---	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Mv:					
Landes Variant	---	Siberian peashrub	Green ash, Osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	---
MwB. Mudlavia	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn olive, Amur honeysuckle, lilac.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
MxA. Mudlavia Variant	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn olive, Amur honeysuckle, lilac.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
OdA, OdB2, OfB2. Ockley	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
OgA:					
Ockley	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak, imperial Carolina poplar.
Rush	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
OhC3:					
Ockley	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Kendallville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
OrA, OrB: Ormas	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn olive, Washington hawthorn, Amur honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
Pb: Palms	Whitebelle honeysuckle, common ninebark.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Pd: Palms	Whitebelle honeysuckle, common ninebark.	Silky dogwood, Amur honeysuckle, nannyberry viburnum, Amur privet, tall purple willow.	---	Black willow, golden willow.	Imperial Carolina poplar.
Pe: Palms Variant	Whitebelle honeysuckle, common ninebark.	Amur privet, nannyberry viburnum, Amur honeysuckle, silky dogwood.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Pg: Patton	---	Amur privet, silky dogwood, American cranberrybush, Amur honeysuckle.	White fir, northern white-cedar, blue spruce, Austrian pine, Washington hawthorn, Norway spruce.	Eastern white pine	Pin oak, imperial Carolina poplar.
Pk: Pella	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak, imperial Carolina poplar.
PnB: Piankeshaw Variant	---	Siberian peashrub	Green ash, Osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	---
Pp, Pr. Pits					

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
RmB2, RmD2, RnC3:					
Riddles	---	Amur privet, Amur honeysuckle, American cranberrybush, Washington hawthorn.	Eastern redcedar, Austrian pine, northern white-cedar, Osageorange.	Eastern white pine, Norway spruce, red pine.	---
Miami	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
RoA Rockfield	Silky dogwood	Amur honeysuckle, American cranberrybush, Amur privet.	Austrian pine, northern white-cedar, white fir, Washington hawthorn, blue spruce.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
RrB2:					
Rockfield	Silky dogwood	Amur honeysuckle, American cranberrybush, Amur privet.	Austrian pine, northern white-cedar, white fir, Washington hawthorn, blue spruce.	Norway spruce	Eastern white pine, pin oak.
Williamstown	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Rt, Ru Ross	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce	Pin oak, eastern white pine, imperial Carolina poplar.
RwA Rush	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak, imperial Carolina poplar.
Sn, So Sloan	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ss: Sloan	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
StA: Starks	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
Ud. Udorthents					
Wd: Wallkill	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
We: Warners Variant	---	Washington hawthorn, nannyberry viburnum, Tatarian honeysuckle.	Osageorange, green ash, eastern redcedar, northern white-cedar, white spruce.	Black willow	---
Wk: Washtenaw	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
WoA: Waynetown	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
WpA:					
Waynetown	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
WpA: Sleeth	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak, imperial Carolina poplar.
Wr Westland	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
Ws Westland	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak, imperial Carolina poplar.
WvB2 Williamstown	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AsB2: Alvin	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
At: Armiesburg	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Ba: Beaucoup	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Bb: Beaucoup	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
CaA: Camden	Slight	Slight	Slight	Slight	Slight.
CaB2: Camden	Slight	Slight	Moderate: slope.	Slight	Slight.
CeG:					
Casco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cg: Ceresco	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Ck: Ceresco Variant	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Cn: Cohoctah	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Cp: Cohoctah	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Cr: Cohoctah Variant	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
CtB: Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: large stones, droughty.
CvA: Crosby	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
CwB:					
Crosby	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Fincastle	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CyB:					
Crosier	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Cz Cyclone	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
FaA, FbB:					
Fincastle	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Starks	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
FsA Fox	Slight	Slight	Slight	Slight	Slight.
FsB2 Fox	Slight	Slight	Moderate: slope.	Slight	Slight.
FtC3 Fox	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
HkG Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HnG:					
Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
Hw Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Jr Jules	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Js:					
Jules	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Stonelick	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
KcA, KcB2 Kalamazoo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
KfA: Kendall	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
KgA:					
Kendall	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Fincastle	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ld: Landes	Severe: flooding.	Slight	Slight	Slight	Moderate: small stones.
Lo: Landes	Severe: flooding.	Slight	Slight	Slight	Moderate: flooding.
Ls:					
Landes	Severe: flooding.	Slight	Slight	Slight	Moderate: small stones.
Moundhaven	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: droughty, flooding.
Ma, Mb: Mahalasville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mc:					
Mahalasville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Treaty	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MdB2:					
Martinsville	Slight	Slight	Moderate: slope.	Slight	Slight.
Miami	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
MfC3:					
Martinsville	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Miami	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MhD3: Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
MkB2:					
Miami	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
Crosier	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Mm, Mo: Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mp: Milford	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Mt: Millsdale	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MuB: Milton Variant	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Slight	Severe: thin layer, area reclaim.
Mv:					
Moundhaven	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Landes Variant	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
MwB: Mudlavia	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Severe: droughty.
MxA: Mudlavia Variant	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, thin layer, area reclaim.
OdA: Ockley	Slight	Slight	Moderate: small stones.	Slight	Slight.
OdB2: Ockley	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
OfB2: Ockley	Slight	Slight	Moderate: slope.	Slight	Slight.
OgA:					
Ockley	Slight	Slight	Slight	Slight	Slight.
Rush	Slight	Slight	Slight	Slight	Slight.
OhC3:					
Ockley	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Kendallville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
OrA: Ormas	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
OrB: Ormas	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Pb, Pd: Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Pe: Palms Variant	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Pg: Patton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pk: Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
PnB: Piankeshaw Variant	Severe: flooding.	Moderate: small stones.	Severe: small stones.	Slight	Severe: droughty.
Pp, Pr. Pits					
RmB2:					
Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Miami	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
RmD2:					
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
RnC3:					
Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Miami	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
RoA: Rockfield	Slight	Slight	Slight	Slight	Slight.
RrB2:					
Rockfield	Slight	Slight	Moderate: slope.	Slight	Slight.
Williamstown	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
Rt, Ru: Ross	Severe: flooding.	Slight	Slight	Slight	Slight.
RwA: Rush	Slight	Slight	Slight	Slight	Slight.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Sn, So: Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ss: Sloan	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
StA: Starks	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ud. Udorthents					
Wd: Wallkill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, erodes easily.	Severe: ponding.
We: Warners Variant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Wk: Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
WoA: Waynetown	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
WpA:					
Waynetown	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Sleeth	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Wr, Ws: Westland	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
WvB2: Williamstown	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AsB2 Alvin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
At Armiesburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ba Beaucoup	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Bb Beaucoup	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
CaA, CaB2 Camden	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CeG:										
Casco	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Hennepin	Very poor.	Poor	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
Cg Ceresco	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ck Ceresco Variant	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Cn Cohoctah	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Cp Cohoctah	Good	Good	Good	Good	Good	Good	Good	Fair	Good	Good.
Cr Cohoctah Variant	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
CtB Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
CvA Crosby	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CwB:										
Crosby	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fincastle	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CyB:										
Crosier	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Cz: Cyclone	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
FaA:										
Fincastle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Starks	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
FbB:										
Fincastle	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Starks	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
FsA, FsB2: Fox	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FtC3: Fox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HkG: Hennepin	Very poor.	Poor	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
HnG:										
Hennepin	Very poor.	Poor	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
Hw: Houghton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Jr: Jules	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Js:										
Jules	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Stonelick	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
KcA, KcB2: Kalamazoo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
KfA: Kendall	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
KgA:										
Kendall	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Fincastle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ld, Lo: Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ls:										
Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ls:										
Moundhaven	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Ma Mahalasville	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Poor.
Mb Mahalasville	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Mc:										
Mahalasville	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Treaty	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MdB2:										
Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Miami	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MfC3:										
Martinsville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Miami	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MhD3 Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MkB2:										
Miami	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Crosier	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Mm, Mo, Mp Milford	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Mt Millsdale	Fair	Fair	Fair	Fair	Poor	Good	Fair	Fair	Fair	Fair.
MuB Milton Variant	Very poor.	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
Mv:										
Moundhaven	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Landes Variant	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
MwB Mudlavia	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
MxA Mudlavia Variant	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Poor	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
OdA, OdB2, OfB2----Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OgA:										
Ockley-----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Rush-------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OhC3:										
Ockley-----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Kendallville------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
OrA, OrB----------Ormas	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Pb----------------Palms	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Pd----------------Palms	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Pe----------------Palms Variant	Poor	Poor	Poor	Poor	Poor	Good	Fair	Poor	Poor	Good.
Pg----------------Patton	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Pk----------------Pella	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
PnB---------------Piankeshaw Variant	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
Pp, Pr. Pits										
RmB2:										
Riddles-----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Miami-------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RmD2:										
Riddles-----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Miami-------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RnC3:										
Riddles-----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
RnC3:										
Miami	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RoA: Rockfield	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
RrB2:										
Rockfield	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Williamstown	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Rt, Ru: Ross	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RwA: Rush	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sn, So, Ss: Sloan	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
StA: Starks	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ud. Udorthents										
Wd: Wallkill	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
We: Warners Variant	Very poor.	Poor	Poor	Poor	Poor	Good	Very poor.	Very poor.	Poor	Poor.
Wk: Washtenaw	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
WoA: Waynetown	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
WpA:										
Waynetown	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Sleeth	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Wr, Ws: Westland	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
WvB2: Williamstown	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AsB2------------- Alvin	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
At--------------- Armiesburg	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
Ba--------------- Beaucoup	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Bb--------------- Beaucoup	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
CaA-------------- Camden	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
CaB2------------- Camden	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
CeG:						
Casco------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hennepin---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cg--------------- Ceresco	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
Ck--------------- Ceresco Variant	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
Cn--------------- Cohoctah	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness.
Cp--------------- Cohoctah	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding.
Cr--------------- Cohoctah Variant	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding, flooding.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CtB: Coloma	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones, droughty.
CvA: Crosby	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
CwB:						
Crosby	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Fincastle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
CyB:						
Crosier	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Cz: Cyclone	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
FaA, FbB:						
Fincastle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Starks	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
FsA: Fox	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
FsB2: Fox	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
FtC3: Fox	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: small stones, slope.
HkG: Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HnG:						
Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Hw: Houghton	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Jr: Jules	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
Js:						
Jules	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
Stonelick	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
KcA: Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: small stones.
KcB2: Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Moderate: small stones.
KfA: Kendall	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
KgA:						
Kendall	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Fincastle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ld: Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Moderate: small stones.
Lo: Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Ls:						
Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: small stones.
Moundhaven	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Ma, Mb: Mahalasville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Mc:						
Mahalasville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Treaty	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
MdB2:						
Martinsville	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Miami	Moderate: dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
MfC3:						
Martinsville	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Miami	Moderate: slope, dense layer.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MhD3 Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
MkB2:						
Miami	Moderate: dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
Crosier	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
Mm, Mo Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Mp Milford	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
Mt Millsdale	Severe: depth to rock, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, depth to rock, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
MuB Milton Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer, area reclaim.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Mv:						
Moundhaven-------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Landes Variant---	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
MwB--------------- Mudlavia	Severe: cutbanks cave.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, frost action, large stones.	Severe: droughty.
MxA--------------- Mudlavia Variant	Severe: depth to rock.	Moderate: shrink-swell, depth to rock, large stones.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock, large stones.	Moderate: depth to rock, shrink-swell, frost action.	Moderate: small stones, thin layer, area reclaim.
OdA--------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
OdB2-------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
OfB2-------------- Ockley	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
OgA:						
Ockley-----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
Rush-------------	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
OhC3:						
Ockley-----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
Kendallville-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: slope.
OrA--------------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
OrB--------------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Pb---------------- Palms	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Pd---------------- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength, subsides.	Severe: ponding, subsides.	Severe: ponding, low strength, subsides.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
Pe---------------- Palms Variant	Severe: depth to rock, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Pg---------------- Patton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Pk---------------- Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
PnB--------------- Piankeshaw Variant	Moderate: large stones.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action, large stones.	Severe: droughty.
Pp, Pr. Pits						
RmB2:						
Riddles-----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
Miami-------------	Moderate: dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
RmD2:						
Riddles-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Miami-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
RnC3:						
Riddles-----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
Miami-------------	Moderate: slope, dense layer.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
RoA--------------- Rockfield	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
RrB2:						
Rockfield	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Williamstown	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
Rt, Ru: Ross	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.	Slight.
RwA: Rush	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Sn: Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
So: Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
Ss: Sloan	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding.
StA: Starks	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ud. Udorthents						
Wd: Wallkill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
We: Warners Variant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Wk: Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
WoA: Waynetown	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
WpA:						
Waynetown	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WpA:						
Sleeth	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Wr: Westland	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Ws: Westland	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
WvB2: Williamstown	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AsB2 Alvin	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
At Armiesburg	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack.
Ba Beaucoup	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Bb Beaucoup	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
CaA Camden	Slight	Moderate: seepage.	Severe: seepage.	Slight	Fair: too clayey.
CaB2 Camden	Slight	Moderate: seepage, slope.	Severe: seepage.	Slight	Fair: too clayey.
CeG:					
Casco	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Hennepin	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Cg Ceresco	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
Ck Ceresco Variant	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
Cn Cohoctah	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
Cp Cohoctah	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding, thin layer.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Cr----------------- Cohoctah Variant	Severe: flooding, ponding.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding.
CtB---------------- Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
CvA---------------- Crosby	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
CwB:					
Crosby-------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Fincastle----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
CyB:					
Crosier------------	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Whitaker-----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Cz----------------- Cyclone	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
FaA, FbB:					
Fincastle----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Starks-------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
FsA, FsB2---------- Fox	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
FtC3--------------- Fox	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
HkG---------------- Hennepin	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
HnG:					
Hennepin-----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HnG: Rock outcrop.					
Hw-----Houghton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Jr-----Jules	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Js: Jules-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Stonelick-----	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: seepage.
KcA, KcB2-----Kalamazoo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
KfA-----Kendall	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
KgA: Kendall-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Fincastle-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ld-----Landes	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Lo-----Landes	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Ls: Landes-----	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Moundhaven-----	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Ma-----Mahalasville	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
Mb-----Mahalasville	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mc:					
Mahalasville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
Treaty	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
MdB2:					
Martinsville	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Miami	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
MfC3:					
Martinsville	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Miami	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
MhD3 Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MkB2:					
Miami	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Crosier	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Mm, Mo Milford	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Mp Milford	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Mt Millsdale	Severe: thin layer, seepage, ponding.	Severe: depth to rock, seepage, ponding.	Severe: depth to rock, seepage, ponding.	Severe: ponding.	Poor: area reclaim, too clayey, hard to pack.
MuB Milton Variant	Severe: thin layer, seepage.	Severe: depth to rock, seepage, large stones.	Severe: depth to rock, seepage, large stones.	Severe: seepage.	Poor: area reclaim, large stones, thin layer.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mv:					
Moundhaven	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Landes Variant	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
MwB Mudlavia	Moderate: percs slowly, large stones.	Severe: seepage.	Severe: seepage.	Slight	Poor: too clayey, small stones.
MxA Mudlavia Variant	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, small stones, thin layer.
OdA, OdB2 Ockley	Slight	Severe: seepage.	Severe: seepage.	Slight	Poor: small stones.
OfB2 Ockley	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
OgA:					
Ockley	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Rush	Severe: percs slowly.	Severe: seepage.	Slight	Slight	Poor: small stones.
OhC3:					
Ockley	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Kendallville	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
OrA, OrB Ormas	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Pb Palms	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Pd Palms	Severe: ponding, subsides.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Pe Palms Variant	Severe: subsides, thin layer, seepage.	Severe: depth to rock, seepage, excess humus.	Severe: depth to rock, seepage, ponding.	Severe: ponding.	Poor: area reclaim, ponding, excess humus.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pg: Patton	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
Pk: Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
PnB: Piankeshaw Variant	Moderate: flooding, large stones.	Severe: seepage, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: seepage, small stones.
Pp, Pr. Pits					
RmB2:					
Riddles	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
Miami	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
RmD2:					
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
RnC3:					
Riddles	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Miami	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
RoA: Rockfield	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
RrB2:					
Rockfield	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Williamstown	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
Rt, Ru: Ross	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
RwA: Rush	Slight	Moderate: seepage.	Severe: seepage.	Slight	Fair: too clayey.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Sn: Sloan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
So: Sloan	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Ss: Sloan	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, depth to rock, seepage.	Severe: flooding, ponding.	Poor: ponding.
StA: Starks	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ud. Udorthents					
Wd: Wallkill	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
We: Warners Variant	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Wk: Washtenaw	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
WoA: Waynetown	Severe: wetness.	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
WpA:					
Waynetown	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Sleeth	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Wr: Westland	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
Ws: Westland	Severe: ponding.	Severe: seepage, ponding.	Severe: depth to rock, seepage, ponding.	Severe: ponding.	Poor: ponding.
WvB2: Williamstown	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AsB2 Alvin	Good	Probable	Improbable: too sandy.	Good.
At Armiesburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ba, Bb Beaucoup	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
CaA, CaB2 Camden	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
CeG:				
Casco	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Cg Ceresco	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Ck Ceresco Variant	Fair: wetness.	Probable	Probable	Fair: area reclaim.
Cn Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Cp Cohoctah	Poor: wetness.	Probable	Probable	Poor: area reclaim, wetness.
Cr Cohoctah Variant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
CtB Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
CvA Crosby	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CwB:				
Crosby	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Fincastle	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CyB:				
Crosier	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cz Cyclone	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
FaA, FbB:				
Fincastle	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Starks	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
FsA, FsB2, FtC3 Fox	Good	Probable	Probable	Poor: small stones, area reclaim.
HkG Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
HnG:				
Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
Hw Houghton	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Jr Jules	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Js:				
Jules	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Stonelick	Good	Probable	Improbable: too sandy.	Fair: small stones.
KcA, KcB2 Kalamazoo	Good	Probable	Probable	Poor: small stones, area reclaim.
KfA Kendall	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
KgA:				
Kendall	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Fincastle	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ld----- Landes	Good-----	Probable-----	Improbable: too sandy.	Fair: too sandy, small stones, thin layer.
Lo----- Landes	Good-----	Probable-----	Improbable: too sandy.	Fair: small stones, thin layer.
Ls:				
Landes-----	Good-----	Probable-----	Improbable: too sandy.	Fair: too sandy, small stones, thin layer.
Moundhaven-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
Ma----- Mahalasville	Poor: wetness.	Probable-----	Probable-----	Poor: wetness.
Mb----- Mahalasville	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Mc:				
Mahalasville-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Treaty-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MdB2:				
Martinsville-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Miami-----	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
MfC3:				
Martinsville-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Miami-----	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope, too clayey.
MhD3----- Miami	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MkB2:				
Miami-----	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
Crosier-----	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mm, Mo, Mp: Milford	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Mt: Millsdale	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
MuB: Milton Variant	Poor: area reclaim, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, thin layer.	Poor: area reclaim, large stones.
Mv:				
Moundhaven	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Landes Variant	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
MwB: Mudlavia	Fair: large stones.	Probable	Probable	Poor: too clayey, small stones, area reclaim.
MxA: Mudlavia Variant	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
OdA, OdB2: Ockley	Good	Probable	Probable	Poor: small stones, area reclaim.
OfB2: Ockley	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
OgA:				
Ockley	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Rush	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
OhC3:				
Ockley	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
Kendallville	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
OrA, OrB: Ormas	Good	Probable	Probable	Poor: too sandy.
Pb: Palms	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pd: Palms	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Pe: Palms Variant	Poor: area reclaim, low strength, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Pg: Patton	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pk: Pella	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
PnB: Piankeshaw Variant	Fair: large stones.	Improbable: small stones.	Probable	Poor: large stones, area reclaim.
Pp, Pr. Pits				
RmB2:				
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Miami	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
RmD2:				
Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Miami	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
RnC3:				
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Miami	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope, too clayey.
RoA: Rockfield	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
RrB2:				
Rockfield	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Williamstown	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Rt, Ru: Ross	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
RwA: Rush	Good	Probable	Probable	Poor: area reclaim.
Sn, So: Sloan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ss: Sloan	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
StA: Starks	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ud. Udorthents				
Wd: Wallkill	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
We: Warners Variant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wk: Washtenaw	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WoA: Waynetown	Fair: wetness.	Probable	Probable	Fair: small stones, area reclaim.
WpA:				
Waynetown	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Sleeth	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Wr: Westland	Poor: wetness.	Probable	Probable	Poor: wetness, area reclaim.
Ws: Westland	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WvB2: Williamstown	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
AsB2: Alvin	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
At: Armiesburg	Moderate: seepage.	Moderate: hard to pack.	Severe: no water.	Deep to water	Favorable	Favorable.
Ba: Beaucoup	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Wetness.
Bb: Beaucoup	Slight	Severe: ponding.	Severe: slow refill.	Ponding, flooding, frost action.	Ponding	Wetness.
CaA: Camden	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
CaB2: Camden	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
CeG:						
Casco	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy.	Slope, droughty.
Hennepin	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, rooting depth.
Cg: Ceresco	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, soil blowing.	Wetness.
Ck: Ceresco Variant	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, soil blowing.	Wetness.
Cn: Cohoctah	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness	Wetness.
Cp: Cohoctah	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, flooding, frost action.	Ponding	Wetness.
Cr: Cohoctah Variant	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, flooding, frost action.	Ponding, soil blowing.	Wetness.
CtB: Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
CvA------------ Crosby	Slight---------	Severe: piping.	Severe: no water.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily, rooting depth.
CwB:						
Crosby-----------	Moderate: slope.	Severe: piping.	Severe: no water.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily, rooting depth.
Fincastle--------	Moderate: seepage, slope.	Severe: wetness.	Severe: slow refill.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
CyB:						
Crosier----------	Moderate: slope.	Severe: wetness.	Severe: slow refill.	Frost action, slope.	Wetness--------	Wetness.
Whitaker---------	Moderate: seepage, slope.	Severe: wetness.	Severe: cutbanks cave, slow refill.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
Cz-------------- Cyclone	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Wetness.
FaA:						
Fincastle--------	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
Starks-----------	Moderate: seepage.	Severe: thin layer, wetness.	Severe: cutbanks cave.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
FbB:						
Fincastle--------	Moderate: seepage, slope.	Severe: wetness.	Severe: slow refill.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
Starks-----------	Moderate: seepage, slope.	Severe: thin layer, wetness.	Severe: cutbanks cave.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
FsA, FsB2--------- Fox	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
FtC3------------- Fox	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy.	Slope.
HkG-------------- Hennepin	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope, rooting depth.
HnG:						
Hennepin---------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope, rooting depth.
Rock outcrop.						

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Hw: Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
Jr: Jules	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Js:						
Jules	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Stonelick	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
KcA, KcB2: Kalamazoo	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Favorable	Favorable.
KfA: Kendall	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
KgA:						
Kendall	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
Fincastle	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
Ld: Landes	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
Lo: Landes	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Too sandy	Favorable.
Ls:						
Landes	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
Moundhaven	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
Ma: Mahalasville	Severe: seepage.	Severe: ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding	Wetness.
Mb: Mahalasville	Severe: seepage.	Severe: ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
Mc:						
Mahalasville	Moderate: seepage.	Severe: thin layer, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding	Wetness.
Treaty	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, erodes easily.	Wetness, erodes easily.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
MdB2:						
Martinsville	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Miami	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
MfC3:						
Martinsville	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Miami	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily, rooting depth.
MhD3 Miami	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily, rooting depth.
MkB2:						
Miami	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
Crosier	Moderate: slope.	Severe: thin layer, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness.
Mm, Mo Milford	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
Mp Milford	Slight	Severe: wetness.	Severe: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Mt Millsdale	Moderate: depth to rock, seepage.	Severe: ponding.	Severe: no water.	Ponding, thin layer, frost action.	Depth to rock, area reclaim, ponding.	Wetness, depth to rock, area reclaim.
MuB Milton Variant	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, area reclaim, large stones.	Depth to rock, area reclaim, large stones.
Mv:						
Moundhaven	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
Landes Variant	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
MwB Mudlavia	Severe: seepage.	Severe: large stones.	Severe: no water.	Deep to water	Large stones	Large stones, droughty.
MxA Mudlavia Variant	Moderate: depth to rock, seepage.	Moderate: thin layer, large stones.	Severe: no water.	Deep to water	Large stones, depth to rock, area reclaim.	Large stones, droughty, depth to rock.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
OdA, OdB2 Ockley	Severe: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
OfB2 Ockley	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
OgA:						
Ockley	Moderate: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Rush	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
OhC3:						
Ockley	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Kendallville	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily, rooting depth.
OrA, OrB Ormas	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Soil blowing	Droughty.
Pb Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness, rooting depth.
Pd Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
Pe Palms Variant	Moderate: depth to rock, seepage.	Severe: ponding, excess humus.	Severe: depth to rock, slow refill.	Ponding, thin layer, subsides.	Depth to rock, area reclaim, ponding.	Wetness, depth to rock, area reclaim.
Pg Patton	Moderate: seepage.	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
Pk Pella	Moderate: seepage.	Severe: ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Wetness.
PnB Piankeshaw Variant	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones	Large stones, droughty.
Pp, Pr. Pits						
RmB2:						
Riddles	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Favorable	Favorable.
Miami	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
RmD2, RnC3:						
Riddles	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope	Slope.
Miami	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily, rooting depth.
RoA Rockfield	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Severe: slow refill.	Frost action	Erodes easily, wetness.	Erodes easily.
RrB2:						
Rockfield	Moderate: seepage, slope.	Moderate: thin layer, piping, wetness.	Severe: slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
Williamstown	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
Rt Ross	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
Ru Ross	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
RwA Rush	Moderate: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Sn Sloan	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
So Sloan	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Ss Sloan	Moderate: seepage, depth to rock.	Severe: ponding.	Moderate: slow refill, depth to rock.	Ponding, flooding, frost action.	Ponding	Wetness.
StA Starks	Moderate: seepage.	Severe: thin layer, wetness.	Severe: cutbanks cave.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
Ud. Udorthents						
Wd Wallkill	Severe: seepage.	Severe: ponding.	Moderate: slow refill.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
We Warners Variant	Severe: seepage.	Severe: wetness.	Severe: slow refill.	Frost action, slope.	Wetness	Wetness.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Wk----------------- Washtenaw	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
WoA---------------- Waynetown	Moderate: seepage.	Severe: wetness.	Severe: cutbanks cave.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
WpA:						
Waynetown---------	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
Sleeth------------	Severe: seepage.	Severe: thin layer, wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
Wr----------------- Westland	Severe: seepage.	Severe: ponding, thin layer.	Severe: cutbanks cave.	Ponding, frost action.	Ponding---------	Wetness.
Ws----------------- Westland	Severe: seepage.	Severe: thin layer, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding---------	Wetness.
WvB2--------------- Williamstown	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AsB2 Alvin	0-9	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	80-95	30-60	<25	NP-4
	9-14	Very fine sandy loam, sandy loam, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	80-95	30-60	<25	NP-4
	14-56	Very fine sandy loam, sandy loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	100	70-100	20-80	15-40	NP-15
	56-80	Sand, fine sandy loam, loamy fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	90-100	45-95	4-35	<20	NP-4
At Armiesburg	0-22	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
	22-80	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-55	20-35
Ba Beaucoup	0-11	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	15-25
	11-49	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	15-30
	49-65	Stratified sandy loam to silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	90-100	60-95	20-40	5-20
Bb Beaucoup	0-12	Silt loam	CL, ML	A-6	0	100	100	90-100	80-100	30-40	10-20
	12-40	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	15-30
	40-52	Stratified very fine sandy loam to silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	65-95	25-45	5-25
	52-60	Stratified very fine sandy loam to silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	90-100	60-95	20-40	5-20
CaA, CaB2 Camden	0-9	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	90-100	20-35	3-15
	9-37	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	25-40	15-25
	37-65	Clay loam, sandy loam, silt loam.	ML, SC, SM, CL	A-2, A-4, A-6	0-5	90-100	85-100	60-100	30-70	20-40	3-15
	65-80	Stratified sandy loam to silt loam.	SM, SC, ML, CL	A-2, A-4	0-5	90-100	80-100	50-80	20-60	<25	3-10
CeG: Casco	0-3	Loam	ML, CL-ML, CL	A-4	0	95-100	90-100	75-100	55-90	20-30	3-10
	3-19	Clay loam, gravelly sandy clay loam, gravelly loam.	SC, CL, GC	A-6, A-7, A-2	0-5	60-100	55-100	45-100	20-80	25-46	11-26
	19-60	Stratified sand to gravel.	GP, SP, GP-GM, SP-SM	A-1, A-3, A-2	0-10	30-100	30-100	10-95	2-10	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
CeG:											
Hennepin	0-4	Loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	85-100	70-100	60-95	25-45	5-20
	4-14	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
	14-60	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
Cg Ceresco	0-10	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	60-90	30-50	<29	NP-7
	10-60	Sandy loam, loamy fine sand, silt loam.	SC, SM-SC, CL, CL-ML	A-2, A-4	0	100	100	60-95	15-80	20-30	4-10
Ck Ceresco Variant	0-10	Fine sandy loam	CL-ML, SM-SC, ML, SM	A-4	0	100	95-100	65-85	40-55	<30	NP-10
	10-29	Fine sandy loam	CL-ML, SM-SC, ML, SM	A-4	0	100	95-100	65-85	40-55	<30	NP-10
	29-48	Sandy loam	SM, SC, SM-SC	A-4, A-2-4	0	100	95-100	55-70	30-40	<30	NP-10
	48-60	Very gravelly loamy coarse sand.	GM, GP-GM	A-1	0-5	45-55	40-50	20-40	5-15	---	NP
Cn Cohoctah	0-15	Loam	ML, CL, CL-ML	A-4	0	100	100	85-95	60-85	<30	NP-10
	15-39	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	85-100	70-90	30-70	<30	NP-10
	39-70	Loam, sandy loam, loamy sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	85-100	65-90	20-70	<30	NP-10
Cp Cohoctah	0-10	Loam	ML, CL, CL-ML	A-4	0	100	100	65-95	50-75	<30	NP-10
	10-40	Loam, sandy loam, fine sandy loam.	ML, SM, CL, SC	A-4, A-2	0	95-100	85-100	50-95	30-70	20-30	NP-10
	40-60	Sand, gravelly coarse sand, very gravelly loamy coarse sand.	SP-SM, SP, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-90	35-85	30-60	0-10	---	NP
Cr Cohoctah Variant	0-10	Very fine sandy loam.	CL, ML, CL-ML	A-4	0	100	100	85-95	50-65	<30	NP-10
	10-32	Fine sandy loam, sandy loam.	SM-SC, SC, SM	A-4, A-2-4	0	100	95-100	55-85	30-50	<30	NP-10
	32-44	Fine sandy loam, sandy loam.	SM-SC, SC, SM	A-4, A-2-4	0	100	95-100	55-85	30-50	<30	NP-10
	44-60	Fine sandy loam, loamy sand.	SM-SC, SM, SP-SM	A-2-4, A-4	0	100	95-100	50-80	10-40	<25	NP-7
CtB Coloma	0-9	Loamy sand	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
	9-42	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	42-80	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP
CvA Crosby	0-9	Silt loam	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	50-90	15-30	4-15
	9-32	Clay loam, silty clay loam, clay.	CL	A-6, A-7	0-3	90-100	85-100	75-95	65-95	35-50	15-25
	32-60	Loam	CL, ML, CL-ML	A-4, A-6	0-3	85-100	80-95	75-90	50-65	15-30	4-15

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
CwB:											
Crosby----------	0-8	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	50-90	15-30	4-15
	8-27	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-3	90-100	85-100	70-95	50-95	30-45	10-20
	27-60	Loam------------	CL, ML, CL-ML	A-4, A-6	0-3	85-100	80-95	75-90	50-65	15-30	4-15
Fincastle-------	0-8	Silt loam--------	CL, ML, CL-ML	A-4	0	100	95-100	90-100	75-93	<25	3-10
	8-36	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-15
	36-52	Clay loam, loam, silty clay loam.	CL	A-6	0	95-100	90-98	85-95	75-85	30-40	10-15
	52-60	Loam------------	CL	A-4, A-6	0-3	88-96	82-90	70-86	50-66	25-30	8-11
CyB:											
Crosier---------	0-9	Loam------------	CL	A-4, A-6	0	100	95-100	85-95	60-80	22-33	8-15
	9-25	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-95	85-95	75-90	60-70	33-47	15-26
	25-60	Loam, sandy loam	CL, ML	A-4, A-6	0-3	85-90	80-90	70-85	50-60	25-35	2-12
Whitaker--------	0-9	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	70-90	<30	4-10
	9-20	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
	20-41	Clay loam, sandy clay loam, loam.	CL, SC	A-4, A-6	0	100	95-100	75-100	35-80	25-40	9-20
	41-53	Stratified silt loam to loamy sand.	ML, CL-ML, SM, SM-SC	A-2-4, A-4	0	100	95-100	50-100	15-85	<20	NP-4
	53-60	Sandy loam, loam	ML, CL-ML, SM, SM-SC	A-2-4, A-4	0-3	95-100	90-100	55-90	30-70	<20	NP-6
Cz--------------- Cyclone	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	12-25
	12-55	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	15-30
	55-59	Loam------------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-95	50-80	25-40	4-15
	59-68	Loam------------	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	50-75	20-30	6-15
FaA, FbB:											
Fincastle-------	0-9	Silt loam--------	CL, ML, CL-ML	A-4	0	100	95-100	90-100	75-93	<25	3-10
	9-33	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-15
	33-48	Clay loam, loam, silty clay loam.	CL	A-6	0	95-100	90-98	85-95	75-85	30-40	10-15
	48-60	Loam------------	CL	A-4, A-6	0-3	88-96	82-90	70-86	50-66	25-30	8-11
Starks----------	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	20-35	4-15
	10-35	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	35-45	15-25
	35-46	Loam, silty clay loam, sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	95-100	90-100	80-95	40-80	25-40	6-17
	46-60	Stratified loamy sand to silt loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	90-100	80-95	40-90	30-60	<30	NP-15
FsA, FsB2-------- Fox	0-9	Sandy loam-------	SM, SM-SC	A-4, A-2	0	95-100	95-100	55-80	20-50	<25	2-7
	9-35	Gravelly clay loam, loam, sandy clay loam.	CL, SC, GC	A-2, A-6, A-7	0-5	55-100	55-100	30-100	15-80	22-45	10-25
	35-60	Sand and gravel, sand, very gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1, A-2, A-3	0-10	30-100	30-100	10-95	2-10	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
FtC3------------- Fox	0-6	Gravelly clay loam.	SC, CL	A-2, A-6	0-3	75-85	65-75	55-75	25-75	25-40	10-20
	6-26	Gravelly clay loam, loam, sandy clay loam.	CL, SC	A-2, A-6, A-7	0-5	55-100	55-100	30-95	15-80	25-45	10-25
	26-60	Sand and gravel, sand.	SP, SM, GP, GM	A-1, A-2, A-3	0-10	30-100	30-100	15-95	2-20	---	NP
HkG-------------- Hennepin	0-4	Loam------------	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	85-100	70-100	60-95	25-45	5-20
	4-16	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
	16-60	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
HnG:											
Hennepin--------	0-4	Loam------------	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	85-100	70-100	60-95	25-45	5-20
	4-16	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
	16-60	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
Rock outcrop.											
Hw--------------- Houghton	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
Jr--------------- Jules	0-6	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	6-60	Silt loam, fine sandy loam.	ML	A-4	0	100	100	55-100	15-100	27-36	4-10
Js:											
Jules-----------	0-9	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	9-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	85-100	30-100	27-36	4-10
Stonelick-------	0-9	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	85-100	75-100	45-75	25-55	<24	NP-6
	9-60	Stratified loam to loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-b	0	85-100	75-100	40-60	5-40	<15	NP
KcA, KcB2-------- Kalamazoo	0-9	Loam------------	ML, CL-ML, CL	A-4, A-6	0-5	95-100	70-100	65-90	50-70	<35	NP-15
	9-34	Clay loam, sandy clay loam, gravelly sandy loam.	SC, CL	A-4, A-6, A-7, A-2	0-5	80-100	70-95	40-95	24-80	25-45	7-25
	34-50	Loamy coarse sand, loamy sand, gravelly loamy sand.	SM, SP-SM, SM-SC	A-2-4, A-1-b	0-5	80-100	60-95	30-70	10-30	<25	NP-7
	50-60	Sand, gravelly sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-5	40-100	25-100	10-70	0-15	---	NP
KfA-------------- Kendall	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	20-35	5-15
	10-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-20
	60-70	Stratified sandy loam to silt loam.	CL, CL-ML, SM-SC, SC	A-2, A-4	0-5	90-100	80-95	60-90	30-70	<25	4-10

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
KgA:											
Kendall	0-10	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	20-35	5-15
	10-49	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-20
	49-60	Stratified sandy loam to silt loam.	CL, CL-ML, SM-SC, SC	A-2, A-4	0-5	90-100	80-95	60-90	30-70	<25	4-10
Fincastle	0-9	Silt loam	CL, ML, CL-ML	A-4	0	100	95-100	90-100	75-93	<25	3-10
	9-30	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-15
	30-42	Clay loam, loam, silty clay loam.	CL	A-6	0	95-100	90-98	85-95	75-85	30-40	10-15
	42-60	Loam	CL	A-4, A-6	0-3	88-96	82-90	70-86	50-66	25-30	8-11
Ld Landes	0-17	Fine sandy loam	SM, SC, SM-SC	A-4, A-2-4	0	100	70-100	70-95	20-50	<25	NP-10
	17-45	Loam, very fine sandy loam, loamy fine sand.	SM, CL-ML, SC, SM-SC	A-4, A-2-4	0	100	85-100	70-100	15-60	<25	NP-10
	45-80	Stratified sand to silt loam.	SM, SP-SM, SC, SM-SC	A-4, A-2-4	0	100	85-100	70-85	10-50	<30	NP-10
Lo Landes	0-14	Loam	CL, CL-ML	A-4, A-6	0	100	90-100	85-95	50-75	25-35	5-15
	14-26	Fine sandy loam, very fine sandy loam, loamy fine sand.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	85-100	70-95	20-70	<25	NP-10
	26-60	Stratified sand to silt loam.	SM, ML, SP-SM, SC	A-2, A-4	0	100	95-100	60-95	10-70	<30	NP-10
Ls:											
Landes	0-15	Fine sandy loam	SM, SC, SM-SC	A-4, A-2-4	0	100	70-100	70-95	20-50	<25	NP-10
	15-39	Sandy loam, very fine sandy loam, loamy fine sand.	SM, CL-ML, SC, SM-SC	A-4, A-2-4	0	100	85-100	50-100	15-60	<25	NP-10
	39-60	Stratified sand to silt loam.	SM, SP-SM, SC, SM-SC	A-4, A-2-4	0	100	85-100	70-85	10-50	<30	NP-10
Moundhaven	0-9	Loamy fine sand	SM	A-2-4	0	100	95-100	50-75	15-30	<20	NP-4
	9-54	Stratified sand to silt loam.	SW-SM, SM, SP-SM	A-3, A-2-4	0	100	95-100	50-80	5-35	<20	NP-3
	54-60	Loamy sand, sand	SP, SP-SM, SM	A-1-b, A-2-4, A-3	0	100	95-100	45-75	3-30	<20	NP
Ma Mahalasville	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-95	30-45	10-20
	12-45	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-95	30-45	10-20
	45-50	Loam, silt loam, gravelly loam.	CL, CL-ML	A-4, A-6	0-2	95-100	75-100	70-90	50-75	<30	4-12
	50-65	Gravelly coarse sand, gravelly sandy loam.	GP, GM, SP, SM	A-1	1-5	45-80	30-55	15-40	3-16	---	NP
Mb Mahalasville	0-11	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-95	35-45	15-25
	11-30	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-95	35-45	15-25
	30-47	Clay loam, loam	CL, CL-ML	A-4, A-6	0-3	90-100	85-100	70-95	50-80	25-40	5-20
	47-54	Gravelly loamy sand.	SP-SM, SM	A-1	0-5	60-75	50-60	25-45	5-20	<20	NP-4
	54-60	Loam	CL-ML, CL	A-4, A-6	0-3	90-100	85-95	70-90	50-70	20-30	5-11

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Mc:											
Mahalasville----	0-11	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	11-29	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-95	38-54	20-32
	29-48	Silty clay loam, clay loam, sandy loam.	ML, CL-ML, CL	A-6, A-4	0	95-100	90-95	55-95	30-75	22-35	3-15
	48-60	Stratified silt to sand.	CL, SC, SP-SC, CL-ML	A-4, A-2-4	0	75-90	70-80	50-80	10-60	15-30	NP-10
Treaty----------	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	10-30	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	30-40	10-15
	30-48	Clay loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0	95-100	90-100	75-95	55-85	25-40	5-15
	48-60	Loam, silt loam	CL-ML, CL	A-4, A-6	0	90-100	90-95	75-90	55-75	20-30	5-15
MdB2:											
Martinsville----	0-8	Loam-------------	CL-ML, CL	A-4, A-6	0	100	90-100	75-100	55-90	<30	4-11
	8-35	Silty clay loam, clay loam, loam.	CL	A-4, A-6	0	100	90-100	75-100	55-90	25-40	9-20
	35-65	Sandy clay loam, sandy loam, loam.	SM-SC, SC, CL, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	85-100	50-95	30-65	20-35	5-15
	65-70	Loam, sandy loam	CL-ML, ML, SM, SM-SC	A-4	0-3	90-100	85-95	50-85	40-70	<25	3-7
Miami-----------	0-8	Loam-------------	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	8-35	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	35-60	Loam-------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
MfC3:											
Martinsville----	0-7	Clay loam--------	CL	A-6	0	95-100	90-100	80-100	60-80	30-40	10-20
	7-40	Silty clay loam, clay loam, loam.	CL	A-4, A-6	0	100	90-100	75-100	55-90	25-40	9-20
	40-61	Sandy clay loam, sandy loam, loam.	SM-SC, SC, CL, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	85-100	50-95	30-65	20-35	5-15
	61-70	Loam, sandy loam	CL-ML, ML, SM, SM-SC	A-4	0-3	90-100	85-95	50-85	40-70	<25	3-7
Miami-----------	0-6	Clay loam--------	CL	A-6	0	100	90-100	75-95	65-95	30-40	15-20
	6-25	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	25-30	Loam-------------	CL, SC	A-4, A-6	0-3	85-100	85-100	70-90	40-90	25-35	8-15
	30-60	Loam-------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
MhD3------------- Miami	0-6	Clay loam--------	CL	A-6	0	100	90-100	75-95	65-95	30-40	15-20
	6-26	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	26-60	Loam-------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MkB2:											
Miami	0-7	Loam	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	7-23	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	23-31	Loam	CL, SC	A-4, A-6	0-3	85-100	85-100	70-90	40-90	25-35	8-15
	31-60	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
Crosier	0-8	Silt loam	CL	A-4, A-6	0	100	95-100	85-95	60-80	22-33	8-15
	8-36	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	90-95	85-95	75-90	60-70	33-47	15-26
	36-60	Loam, sandy loam	CL, ML	A-4, A-6	0-3	85-90	80-90	70-85	50-60	25-35	2-12
Mm Milford	0-14	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	75-95	40-55	20-30
	14-60	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	95-100	90-100	75-100	40-60	20-40
	60-80	Stratified clay to sandy loam.	CL, SC	A-6, A-7	0	95-100	95-100	90-100	45-100	25-50	10-30
Mo Milford	0-15	Silt loam	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	70-90	25-40	5-20
	15-68	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	95-100	90-100	75-100	40-60	20-40
	68-80	Stratified clay to sandy loam.	CL, SC	A-6, A-7	0	95-100	95-100	90-100	45-100	25-50	10-30
Mp Milford	0-14	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	80-95	40-55	20-35
	14-70	Silty clay, silty clay loam.	CH, CL	A-7	0	100	95-100	90-100	80-100	40-60	20-40
	70-80	Stratified silty clay to sandy loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-100	30-50	15-30
Mt Millsdale	0-18	Loam	CL	A-6	0	90-100	80-100	70-100	50-95	25-35	10-20
	18-35	Silty clay loam, gravelly clay loam.	CH, CL	A-7	0-5	85-100	55-100	30-100	30-95	40-60	20-35
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MuB Milton Variant	0-4	Channery silt loam.	CL, CL-ML	A-4	15-25	85-95	80-90	70-90	55-80	25-30	5-10
	4-12	Very channery silt loam.	CL, SC, GC	A-6	40-55	55-80	50-75	45-75	35-70	30-35	10-15
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Mv:											
Moundhaven	0-14	Loamy fine sand	SM	A-2-4	0	100	95-100	50-75	15-30	<20	NP-4
	14-38	Stratified sand to silt loam.	SW-SM, SM, SP-SM	A-3, A-2-4	0	100	95-100	50-80	5-35	<20	NP-3
	38-60	Loamy sand, sand	SP, SP-SM, SM	A-1-b, A-2-4, A-3	0	100	95-100	45-75	3-30	<20	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Mv:											
Landes Variant--	0-14	Fine sandy loam	CL, ML, SM, SC	A-4	0	100	95-100	65-85	40-55	<30	NP-10
	14-39	Fine sandy loam, very fine sandy loam, sandy loam.	CL, ML, SM, SC	A-4	0	100	95-100	65-95	40-65	<30	NP-10
	39-60	Loamy sand, sandy loam.	SM-SC, SM, SC	A-4, A-2-4	0	100	95-100	50-90	15-70	<25	NP-10
MwB-------------- Mudlavia	0-9	Gravelly sandy loam.	SM-SC, SC	A-2-4, A-1-b	0-15	75-80	60-75	35-60	15-35	<25	4-10
	9-39	Very gravelly clay loam, extremely gravelly clay loam.	GC	A-2-7, A-7	25-50	30-60	25-50	20-50	15-50	45-65	25-40
	39-45	Extremely gravelly clay, extremely cobbly clay.	GC	A-2-7, A-7	25-50	30-60	25-50	20-50	15-50	50-65	25-40
	45-60	Extremely gravelly coarse sand, very gravelly coarse sand.	GW, GP, GP-GM, GW-GM	A-1	25-50	15-60	10-50	5-30	0-10	<20	NP
MxA-------------- Mudlavia Variant	0-7	Gravelly loam----	SM-SC, SC	A-4, A-6	5-10	65-70	60-65	50-60	35-50	20-35	5-15
	7-21	Very gravelly clay loam.	GC	A-7, A-2-7	10-25	45-55	40-50	35-50	30-40	40-50	20-25
	21-30	Extremely cobbly clay loam.	GC	A-2-7	45-60	35-45	30-40	25-40	20-35	40-50	20-25
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
OdA, OdB2-------- Ockley	0-9	Silt loam--------	CL, ML, CL-ML	A-4	0	95-100	85-100	70-100	50-90	15-30	3-10
	9-35	Silty clay loam, clay loam, silt loam.	CL	A-6, A-4	0	90-100	80-100	70-90	55-90	25-40	8-15
	35-56	Gravelly clay loam, gravelly sandy clay loam.	CL, SC	A-6, A-4, A-2	0-2	70-85	45-85	40-70	25-55	25-40	8-15
	56-60	Stratified sand to very gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	10-40	2-10	---	NP
OfB2------------- Ockley	0-9	Loam------------	CL-ML, CL	A-4, A-6	0	100	90-100	80-100	60-90	20-30	4-11
	9-18	Sandy clay loam, clay loam.	CL	A-6, A-7	0	100	90-100	80-100	60-95	35-45	15-20
	18-23	Sandy clay loam, sandy loam.	SC	A-4, A-6, A-2-6, A-2-4	0	95-100	80-95	55-85	25-50	25-40	7-16
	23-57	Gravelly sandy clay loam.	SC, GC	A-4, A-6, A-2-6, A-2-4	0-3	65-85	60-75	50-70	20-40	25-35	7-15
	57-70	Sandy loam, loam	ML, CL-ML, SM, SM-SC	A-4, A-2-4	0-5	90-100	80-95	55-85	30-70	<25	3-7

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
OgA:											
Ockley	0-9	Silt loam	CL-ML, CL	A-4, A-6	0	100	90-100	80-100	60-90	20-30	4-11
	9-18	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	90-100	80-100	60-95	35-45	15-20
	18-23	Sandy clay loam, sandy loam, clay loam.	SC	A-4, A-6, A-2-6, A-2-4	0	95-100	80-95	55-85	25-50	25-40	7-16
	23-61	Gravelly sandy clay loam, gravelly clay loam.	SC, GC	A-4, A-6, A-2-6, A-2-4	0-3	65-85	60-75	50-70	20-40	25-35	7-15
	61-70	Sandy loam, loam	ML, CL-ML, SM, SM-SC	A-4, A-2-4	0-5	90-100	80-95	55-85	30-70	<25	3-7
Rush	0-9	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	65-90	20-30	5-11
	9-27	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-95	35-45	15-25
	27-33	Clay loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-7, A-2	0	80-100	75-100	60-100	25-80	25-45	5-25
	33-54	Gravelly sandy clay loam, gravelly coarse sandy loam.	SC, SM-SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0-5	55-80	50-75	30-70	15-45	20-40	5-20
	54-58	Very gravelly loamy coarse sand, gravelly loamy sand.	GP-GM, GM, SP-SM, SM	A-1	0-5	40-60	35-55	15-40	5-20	<20	NP-4
	58-65	Loam	CL-ML, CL	A-4, A-6	0-3	90-100	85-95	70-90	50-75	20-30	5-11
OhC3:											
Ockley	0-7	Clay loam	CL	A-6	0	95-100	90-100	80-100	60-80	30-40	10-20
	7-26	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	90-100	80-100	60-95	35-45	15-20
	26-54	Gravelly sandy clay loam, gravelly clay loam.	SC, GC	A-4, A-6, A-2-6, A-2-4	0-3	65-85	60-75	50-70	20-40	25-35	7-15
	54-60	Sandy loam, loam	ML, CL-ML, SM, SM-SC	A-4, A-2-4	0-5	90-100	80-95	55-85	30-70	<25	3-7
Kendallville	0-7	Clay loam	CL	A-6	0-5	90-100	80-100	75-90	65-80	25-40	10-25
	7-26	Clay loam, gravelly loam, sandy clay loam.	CL, CL-ML, SC, GC	A-4, A-6	0-5	70-100	60-95	50-80	45-75	25-40	5-15
	26-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6	0-5	90-100	80-95	60-90	55-75	20-35	3-15

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
OrA, OrB--------- Ormas	0-9	Loamy sand-------	SM	A-2-4	0	95-100	95-100	50-75	15-30	---	NP
	9-33	Sand, fine sand, loamy sand.	SW-SM, SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-70	10-20	---	NP
	33-40	Sandy loam, fine sandy loam, sandy clay loam.	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	40-55	Gravelly sandy clay loam, gravelly coarse sandy loam, gravelly fine sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0-3	60-80	55-80	35-70	20-45	20-40	6-20
	55-60	Gravelly sandy clay loam, gravelly coarse sandy loam, very gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-3, A-1-b, A-2-4	0-3	35-80	30-80	30-55	3-12	---	NP
Pb--------------- Palms	0-19	Sapric material	PT	---	---	---	---	---	---	---	---
	19-60	Clay loam, silty clay loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
Pd--------------- Palms	0-42	Sapric material	PT		0	---	---	---	---	---	---
	42-60	Cobbly loam, very cobbly loam.	GC	A-6, A-2-6	50-75	50-65	45-60	40-60	30-45	30-45	10-15
Pe--------------- Palms Variant	0-32	Sapric material	PT	A-8	0	---	---	---	---	---	---
	32-36	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	15-20
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Pg--------------- Patton	0-14	Silty clay loam	CL	A-6	0	100	100	95-100	80-95	30-40	15-25
	14-54	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	80-100	40-55	15-25
	54-65	Stratified silt loam to silty clay loam.	CL	A-6	0	100	100	95-100	75-95	25-40	10-20
Pk--------------- Pella	0-15	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-95	40-50	15-25
	15-32	Silty clay loam, silty clay, clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-95	30-50	15-30
	32-47	Stratified silty clay loam to sandy loam.	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-90	25-45	10-25
	47-60	Stratified sandy loam to silty clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-5	90-100	80-100	50-100	30-85	20-35	7-20
PnB-------------- Piankeshaw Variant	0-8	Gravelly sandy loam.	SM, SM-SC, SC, GM	A-1-b, A-2-4	5-25	60-80	50-75	30-70	15-30	<28	NP-9
	8-45	Extremely gravelly loam, very gravelly sandy loam.	GC, GP-GM, GM, GM-GC	A-4, A-2-4, A-1	5-40	30-60	20-50	15-50	10-40	<28	NP-9
	45-60	Extremely gravelly sandy loam, gravelly sandy loam, very gravelly loamy coarse sand.	GC, GP-GM, GP-GC, GM	A-1-a, A-2-4	5-30	25-60	15-55	10-45	5-45	<28	NP-9

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Pp, Pr. Pits											
RmB2, RmD2:											
Riddles---------	0-8	Loam------------	CL, ML, CL-ML	A-4	0-3	90-100	75-95	60-95	50-85	<25	NP-8
	8-66	Sandy clay loam, clay loam, fine sandy loam.	CL, SC	A-6	0-3	90-100	75-95	45-90	45-90	25-40	10-20
	66-80	Sandy loam, loam	SM, SM-SC, CL-ML, ML	A-4	0-3	85-95	75-90	45-90	40-90	<20	NP-7
Miami-----------	0-8	Loam------------	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	8-27	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	27-32	Loam------------	CL, SC	A-4, A-6	0-3	85-100	85-100	70-90	40-90	25-35	8-15
	32-60	Loam------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
RnC3:											
Riddles---------	0-7	Loam------------	CL, ML, CL-ML	A-4	0-3	90-100	75-95	60-95	50-85	<25	NP-8
	7-62	Sandy clay loam, clay loam, fine sandy loam.	CL, SC	A-6	0-3	90-100	75-95	45-90	45-90	25-40	10-20
	62-70	Sandy loam, loam	SM, SM-SC, CL-ML, ML	A-4	0-3	85-95	75-90	45-90	40-90	<20	NP-7
Miami-----------	0-6	Clay loam--------	CL	A-6	0	100	90-100	75-95	65-95	30-40	15-20
	6-28	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	28-60	Loam------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
RoA-------------- Rockfield	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	5-15
	9-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	15-20
	32-48	Clay loam, loam, sandy loam.	CL	A-6, A-7	0	95-100	85-100	70-100	50-80	30-45	10-20
	48-57	Loam------------	CL, CL-ML	A-6, A-4	0-3	95-100	90-95	70-90	50-75	25-35	5-15
	57-65	Loam------------	CL, CL-ML	A-4, A-6	0-3	95-100	90-95	70-90	50-75	20-30	5-15
RrB2:											
Rockfield-------	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	5-15
	9-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	15-20
	32-48	Clay loam, loam, sandy loam.	CL	A-6, A-7	0	95-100	85-100	70-100	50-80	30-45	10-20
	48-57	Loam------------	CL, CL-ML	A-6, A-4	0-3	95-100	90-95	70-90	50-75	25-35	5-15
	57-65	Loam------------	CL, CL-ML	A-4, A-6	0-3	95-100	90-95	70-90	50-75	20-30	5-15
Williamstown----	0-9	Loam------------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	4-15
	9-18	Clay loam--------	CL	A-6	0	100	95-100	85-100	70-95	30-40	10-20
	18-30	Loam------------	CL, CL-ML	A-6, A-4	0	100	95-100	80-95	60-80	20-35	5-15
	30-60	Loam------------	ML, CL-ML, CL	A-4, A-6	0-2	100	95-100	80-95	55-75	20-35	3-11

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Rt---------------- Ross	0-28	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-2, A-4	0	90-100	90-100	60-85	30-55	<24	NP-6
	28-68	Loam, silt loam, fine sandy loam.	ML, CL, CL-ML	A-6, A-4, A-7	0	90-100	85-100	70-100	55-95	22-45	3-20
	68-74	Stratified gravelly sandy loam to silt loam.	CL, ML, SM, GM	A-6, A-4, A-2	0-5	65-100	45-100	30-100	25-80	<30	NP-12
Ru---------------- Ross	0-29	Loam-------------	ML, CL-ML, CL	A-4, A-6	0	90-100	90-100	80-100	65-95	20-35	NP-12
	29-66	Loam, silt loam, sandy loam.	ML, CL, CL-ML	A-6, A-4, A-7	0	90-100	85-100	70-100	55-95	22-45	3-20
	66-80	Stratified gravelly sandy loam to clay loam.	CL, ML, SM, GM	A-6, A-4, A-2	0-5	65-100	45-100	30-100	25-80	<30	NP-12
RwA--------------- Rush	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-30	5-15
	9-29	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	70-100	30-40	10-20
	29-35	Clay loam, sandy clay loam, loam.	CL, SC	A-6, A-2-6	1-5	80-100	80-100	60-100	25-75	30-40	10-20
	35-49	Gravelly loam, gravelly clay loam, gravelly sandy clay loam.	CL-ML, CL, SM-SC, SC	A-2-4, A-2-6, A-4, A-6	1-5	65-80	55-75	40-75	15-60	25-35	5-15
	49-56	Very gravelly sandy loam, gravelly sandy loam, gravelly loamy coarse sand.	SM-SC, SC, SP-SC, GC	A-2-4, A-2-6, A-4, A-6	1-5	65-85	25-65	25-65	10-50	20-30	5-15
	56-65	Stratified sand to extremely gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-35	2-10	---	NP
Sn, So----------- Sloan	0-12	Silt loam--------	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	12-57	Silty clay loam, loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	57-60	Stratified gravelly sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
Ss---------------- Sloan	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	65-90	20-30	5-15
	15-29	Loam-------------	CL	A-6, A-7	0	95-100	90-100	75-95	55-75	30-45	10-20
	29-48	Loam-------------	CL	A-6, A-7	0	95-100	90-100	75-95	55-75	30-45	10-20
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
StA--------------- Starks	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	20-35	4-15
	9-39	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	35-45	15-25
	39-63	Loam, silty clay loam, sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	95-100	90-100	80-95	40-80	25-40	6-17
	63-80	Stratified loamy sand to silt loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	90-100	80-95	40-90	30-60	<30	NP-15

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ud. Udorthents											
Wd----------------- Wallkill	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	95-100	90-100	75-100	60-85	16-32	3-12
	9-28	Silt loam, loam, mucky silt loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-85	20-34	6-13
	28-60	Sapric material, hemic material.	PT, OH	A-8	0	---	---	---	---	---	---
We----------------- Warners Variant	0-8	Silt loam--------	CL, CL-ML	A-4	0	100	95-100	85-100	65-90	20-30	5-10
	8-30	Silt loam--------	CL, CL-ML	A-4	0	100	95-100	85-100	65-90	20-30	5-10
	30-60	Marl-------------	---	---	---	---	---	---	---	---	---
Wk----------------- Washtenaw	0-13	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	13-27	Silt loam, loam	CL, ML	A-6, A-4	0	100	100	90-100	70-90	27-36	4-12
	27-80	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	95-100	95-100	90-100	75-95	36-50	15-28
WoA--------------- Waynetown	0-9	Silt loam--------	CL-ML, CL, ML	A-4	0	100	95-100	85-100	70-90	<25	3-8
	9-32	Silty clay loam	CL	A-6	0	100	95-100	90-100	80-95	30-40	10-16
	32-37	Loam, clay loam	CL	A-6, A-4	0	90-100	90-100	75-100	50-80	25-35	8-14
	37-54	Gravelly sandy clay loam, gravelly sandy loam, gravelly clay loam.	CL, SC, GC	A-4, A-6, A-2-4, A-2-6	0-3	60-85	55-80	45-75	20-55	25-35	8-15
	54-60	Gravelly coarse sand, gravelly loamy coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	45-80	45-70	20-50	3-11	---	NP
WpA: Waynetown--------	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	65-90	20-30	5-11
	10-34	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-95	35-45	15-25
	34-42	Very fine sandy loam, fine sandy loam, loam.	CL, CL-ML, SM-SC, SC	A-4, A-6	0-2	90-100	85-100	60-95	35-80	25-40	5-15
	42-58	Gravelly loam, gravelly clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	55-80	50-75	40-75	15-60	20-40	5-20
	58-60	Loam-------------	CL-ML, CL	A-4, A-6	0-3	90-100	85-95	70-90	50-70	20-30	5-11
Sleeth-----------	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	65-90	20-30	5-11
	8-18	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-95	35-45	15-25
	18-34	Clay loam--------	CL	A-6, A-7	0	90-100	85-100	75-100	60-80	35-45	15-25
	34-48	Gravelly sandy clay loam, gravelly loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0-5	55-80	50-75	40-75	15-60	20-40	5-20
	48-56	Very gravelly loamy coarse sand, gravelly loamy coarse sand.	GP-GM, GM, SP-SM, SM	A-1	0-5	40-60	35-55	15-45	5-20	<20	NP-4
	56-60	Loam-------------	CL-ML, CL	A-4, A-6	0-3	90-100	85-95	70-90	50-75	20-30	5-11

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Wr-----------------Westland	0-10	Loam---------------	CL, CL-ML	A-6, A-4	0	100	100	75-100	55-90	20-30	5-11
	10-44	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-4	0	85-100	85-100	50-100	40-80	25-40	8-16
	44-51	Gravelly sandy clay loam, sandy loam, gravelly sandy loam.	SM, SC, ML, CL	A-4, A-6	0-3	70-95	70-95	50-70	40-70	<35	NP-15
	51-60	Gravelly coarse sand, gravelly loamy coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0-5	40-80	35-80	10-40	1-10	---	NP-3
Ws-----------------Westland	0-13	Loam---------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	75-95	55-75	20-35	5-15
	13-35	Clay loam----------	CL	A-6, A-7	0	90-100	85-100	75-100	60-80	35-45	15-20
	35-58	Very gravelly sandy loam, very gravelly loamy sand.	GM, GM-GC	A-2-4, A-1-b	0-5	50-55	45-50	25-50	15-30	<25	NP-7
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WvB2---------------Williamstown	0-9	Silt loam----------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	4-15
	9-30	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	100	95-100	85-100	70-95	30-40	10-20
	30-34	Fine sandy loam	CL, CL-ML	A-6, A-4	0	100	95-100	80-95	60-80	20-35	5-15
	34-60	Loam---------------	ML, CL-ML, CL	A-4, A-6	0-2	100	95-100	80-95	55-75	20-35	3-11

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
AsB2: Alvin	0-9	10-15	1.45-1.65	2.0-6.0	0.14-0.20	4.5-7.3	Low	0.24	5	3	1-2
	9-14	10-15	1.45-1.65	0.6-2.0	0.14-0.20	4.5-6.0	Low	0.24			
	14-56	15-18	1.45-1.65	0.6-2.0	0.12-0.20	4.5-6.0	Low	0.24			
	56-80	3-10	1.55-1.75	2.0-6.0	0.05-0.13	5.1-8.4	Low	0.24			
At: Armiesburg	0-22	27-35	1.30-1.45	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.28	5	7	2-4
	22-80	20-35	1.30-1.45	0.6-2.0	0.18-0.22	6.1-7.8	Moderate	0.28			
Ba: Beaucoup	0-11	27-35	1.25-1.45	0.2-0.6	0.21-0.23	5.6-7.8	Moderate	0.32	5	7	5-6
	11-49	27-35	1.30-1.50	0.2-0.6	0.18-0.20	5.6-7.8	Moderate	0.32			
	49-65	10-30	1.40-1.65	0.2-0.6	0.18-0.22	6.1-8.4	Moderate	0.32			
Bb: Beaucoup	0-12	18-27	1.25-1.40	0.2-0.6	0.22-0.24	5.6-7.8	Low	0.32	5	6	5-6
	12-40	27-35	1.30-1.50	0.2-0.6	0.18-0.20	5.6-7.8	Moderate	0.32			
	40-52	15-30	1.35-1.55	0.2-0.6	0.18-0.22	5.6-7.8	Moderate	0.32			
	52-60	10-30	1.40-1.65	0.2-0.6	0.18-0.22	6.1-8.4	Moderate	0.32			
CaA, CaB2: Camden	0-9	14-27	1.15-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	6	1-2
	9-37	22-35	1.35-1.55	0.6-2.0	0.16-0.20	5.1-7.3	Moderate	0.37			
	37-65	18-30	1.45-1.65	0.6-2.0	0.11-0.22	5.6-7.3	Low	0.37			
	65-80	5-20	1.55-1.75	0.6-6.0	0.11-0.22	5.6-8.4	Low	0.37			
CeG:											
Casco	0-3	10-20	1.35-1.55	0.6-2.0	0.19-0.24	5.6-7.3	Low	0.32	3	5	1-3
	3-19	18-35	1.55-1.65	0.6-2.0	0.09-0.19	5.6-7.8	Moderate	0.32			
	19-60	0-2	1.30-1.70	>20	0.02-0.04	7.4-8.4	Low	0.10			
Hennepin	0-4	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low	0.32	3	6	1-3
	4-14	18-30	1.30-1.60	0.2-0.6	0.14-0.22	6.1-8.4	Low	0.32			
	14-60	18-30	1.70-1.85	0.2-0.6	0.10-0.15	7.4-8.4	Low	0.32			
Cg: Ceresco	0-10	2-15	1.35-1.60	2.0-6.0	0.13-0.18	6.1-7.8	Low	0.20	5	3	3-5
	10-60	10-18	1.40-1.70	2.0-6.0	0.11-0.20	6.6-8.4	Low	0.24			
Ck: Ceresco Variant	0-10	5-18	1.30-1.40	2.0-6.0	0.16-0.18	7.4-7.8	Low	0.20	5	3	2-4
	10-29	5-18	1.50-1.60	2.0-6.0	0.15-0.17	7.4-7.8	Low	0.24			
	29-48	5-18	1.50-1.60	2.0-6.0	0.12-0.14	7.4-7.8	Low	0.24			
	48-60	1-5	1.60-1.70	>20	0.01-0.03	7.9-8.4	Low	0.10			
Cn: Cohoctah	0-15	7-20	1.20-1.60	2.0-6.0	0.18-0.30	6.1-7.8	Low	0.28	5	5	2-5
	15-39	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low	0.28			
	39-70	2-25	1.45-1.65	2.0-6.0	0.08-0.20	6.1-8.4	Low	0.28			
Cp: Cohoctah	0-10	10-20	1.20-1.60	2.0-6.0	0.20-0.22	6.1-7.8	Low	0.28	4	5	2-5
	10-40	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low	0.28			
	40-60	5-10	1.40-1.55	>20	0.02-0.07	7.9-8.4	Low	0.10			
Cr: Cohoctah Variant	0-10	8-18	1.30-1.40	2.0-6.0	0.20-0.22	7.4-8.4	Low	0.28	5	3	3-5
	10-32	8-18	1.50-1.60	2.0-6.0	0.12-0.17	7.9-8.4	Low	0.24			
	32-44	8-18	1.50-1.60	2.0-6.0	0.12-0.17	7.9-8.4	Low	0.24			
	44-60	3-15	1.50-1.70	2.0-6.0	0.08-0.16	7.9-8.4	Low	0.24			
CtB: Coloma	0-9	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-7.3	Low	0.17	5	2	<1
	9-42	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low	0.15			
	42-80	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low	0.15			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
CvA------------- Crosby	0-9	11-24	1.35-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.43	3	5	1-3
	9-32	35-45	1.50-1.60	0.06-0.2	0.15-0.20	4.5-7.3	Moderate-----	0.43			
	32-60	15-27	1.70-2.00	0.06-0.6	0.05-0.17	7.4-8.4	Low----------	0.43			
CwB:											
Crosby----------	0-8	11-24	1.35-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.43	3	5	1-3
	8-27	20-34	1.50-1.60	0.06-0.2	0.15-0.20	5.1-7.3	Moderate-----	0.43			
	27-60	15-27	1.70-2.00	0.06-0.6	0.05-0.17	7.4-8.4	Low----------	0.43			
Fincastle-------	0-8	11-22	1.40-1.55	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	5	1-3
	8-36	23-35	1.45-1.65	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	36-52	24-32	1.45-1.65	0.6-2.0	0.15-0.19	5.1-7.8	Moderate-----	0.37			
	52-60	20-26	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Low----------	0.37			
CyB:											
Crosier---------	0-9	7-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	9-25	20-33	1.40-1.60	0.2-0.6	0.15-0.19	5.1-7.3	Moderate-----	0.32			
	25-60	10-20	1.40-1.60	0.2-0.6	0.10-0.19	6.1-8.4	Low----------	0.32			
Whitaker--------	0-9	10-22	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	1-2
	9-20	27-34	1.55-1.65	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37			
	20-41	20-34	1.55-1.65	0.6-2.0	0.15-0.19	5.1-7.8	Moderate-----	0.37			
	41-53	3-10	1.55-1.70	0.6-2.0	0.10-0.20	6.6-8.4	Low----------	0.37			
	53-60	5-15	1.70-1.85	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.37			
Cz-------------- Cyclone	0-12	27-33	1.40-1.60	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.28	5	7	4-6
	12-55	27-35	1.40-1.60	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43			
	55-59	15-25	1.40-1.60	0.6-2.0	0.15-0.19	6.6-7.8	Low----------	0.43			
	59-68	15-25	1.50-1.80	0.2-0.6	0.05-0.19	7.4-8.4	Low----------	0.43			
FaA, FbB:											
Fincastle-------	0-9	11-22	1.40-1.55	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	5	1-3
	9-33	23-35	1.45-1.65	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	33-48	24-32	1.45-1.65	0.6-2.0	0.15-0.19	5.1-7.8	Moderate-----	0.37			
	48-60	20-26	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Low----------	0.37			
Starks----------	0-10	18-27	1.15-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	10-35	27-35	1.35-1.55	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	35-46	18-30	1.45-1.65	0.6-2.0	0.16-0.19	5.1-7.8	Moderate-----	0.37			
	46-60	5-20	1.55-1.75	0.6-2.0	0.08-0.18	5.1-7.8	Low----------	0.37			
FsA, FsB2-------- Fox	0-9	5-15	1.40-1.70	0.6-2.0	0.11-0.18	5.1-7.3	Low----------	0.24	4	3	1-3
	9-35	18-35	1.55-1.65	0.6-2.0	0.10-0.19	5.1-8.4	Moderate-----	0.32			
	35-60	0-2	1.30-1.70	>6.0	0.02-0.07	7.4-8.4	Low----------	0.10			
FtC3------------ Fox	0-6	20-35	1.55-1.65	0.6-2.0	0.13-0.20	5.1-7.3	Moderate-----	0.24	3	8	.5-2
	6-26	18-35	1.55-1.65	0.6-2.0	0.10-0.19	5.1-8.4	Moderate-----	0.32			
	26-60	0-2	1.30-1.80	>6.0	0.02-0.07	7.4-8.4	Low----------	0.10			
HkG------------- Hennepin	0-4	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	3	6	1-3
	4-16	18-30	1.30-1.60	0.2-0.6	0.14-0.22	6.1-8.4	Low----------	0.32			
	16-60	18-30	1.70-1.85	0.2-0.6	0.10-0.15	7.4-8.4	Low----------	0.32			
HnG:											
Hennepin--------	0-4	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	3	6	1-3
	4-16	18-30	1.30-1.60	0.2-0.6	0.14-0.22	6.1-8.4	Low----------	0.32			
	16-60	18-30	1.70-1.85	0.2-0.6	0.10-0.15	7.4-8.4	Low----------	0.32			
Rock outcrop.											

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Hw---------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	5	2	>70
Jr---------------- Jules	0-6	10-20	1.15-1.40	0.6-2.0	0.20-0.24	7.4-8.4	Low----------	0.37	5	4L	1-2
	6-60	10-18	1.20-1.50	0.6-2.0	0.17-0.22	7.4-8.4	Low----------	0.37			
Js:											
Jules------------	0-9	10-20	1.15-1.40	0.6-2.0	0.20-0.24	7.4-8.4	Low----------	0.37	5	4L	1-2
	9-60	10-18	1.20-1.50	0.6-2.0	0.17-0.22	7.4-8.4	Low----------	0.37			
Stonelick--------	0-9	8-18	1.25-1.50	2.0-6.0	0.09-0.14	7.4-8.4	Low----------	0.24	5	3	.5-2
	9-60	5-18	1.30-1.55	2.0-6.0	0.08-0.14	7.4-8.4	Low----------	0.24			
KcA, KcB2--------- Kalamazoo	0-9	8-25	1.30-1.65	0.6-2.0	0.16-0.22	5.1-7.3	Low----------	0.32	4	5	1-3
	9-34	18-35	1.35-1.70	0.6-2.0	0.10-0.18	5.1-7.3	Moderate-----	0.32			
	34-50	2-15	1.50-1.65	6.0-20	0.02-0.08	5.1-7.8	Low----------	0.15			
	50-60	0-10	1.50-1.65	>20	0.01-0.03	7.4-8.4	Low----------	0.10			
KfA--------------- Kendall	0-10	20-27	1.15-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	10-60	20-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate-----	0.37			
	60-70	10-25	1.55-1.70	0.6-2.0	0.11-0.22	5.6-8.4	Low----------	0.37			
KgA:											
Kendall----------	0-10	20-27	1.15-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	10-49	20-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate-----	0.37			
	49-60	10-25	1.55-1.70	0.6-2.0	0.11-0.22	5.6-8.4	Low----------	0.37			
Fincastle--------	0-9	11-22	1.40-1.55	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	5	1-3
	9-30	23-35	1.45-1.65	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	30-42	24-32	1.45-1.65	0.6-2.0	0.15-0.19	5.1-7.8	Moderate-----	0.37			
	42-60	20-26	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Low----------	0.37			
Ld---------------- Landes	0-17	7-20	1.40-1.60	2.0-6.0	0.13-0.20	6.1-8.4	Low----------	0.20	4	3	2-3
	17-45	5-18	1.60-1.70	2.0-6.0	0.10-0.15	6.1-8.4	Low----------	0.32			
	45-80	5-18	1.60-1.80	6.0-20	0.05-0.15	6.1-8.4	Low----------	0.20			
Lo---------------- Landes	0-14	8-22	1.20-1.40	0.6-2.0	0.20-0.22	6.1-8.4	Low----------	0.28	4	5	2-3
	14-26	5-18	1.45-1.70	2.0-6.0	0.10-0.15	6.1-8.4	Low----------	0.20			
	26-60	5-18	1.60-1.70	6.0-20	0.05-0.15	6.1-8.4	Low----------	0.20			
Ls:											
Landes-----------	0-15	7-20	1.40-1.60	2.0-6.0	0.13-0.20	6.1-8.4	Low----------	0.20	4	3	2-3
	15-39	5-18	1.60-1.70	2.0-6.0	0.10-0.15	6.1-8.4	Low----------	0.32			
	39-60	5-18	1.60-1.80	6.0-20	0.05-0.15	6.1-8.4	Low----------	0.20			
Moundhaven-------	0-9	2-10	1.40-1.50	6.0-20	0.10-0.12	7.4-8.4	Low----------	0.17	5	2	1-2
	9-54	1-8	1.50-1.65	6.0-20	0.06-0.11	7.4-8.4	Low----------	0.17			
	54-60	0-5	1.55-1.70	6.0-20	0.05-0.10	7.4-8.4	Low----------	0.17			
Ma---------------- Mahalasville	0-12	27-35	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.3	Moderate-----	0.28	5	7	3-5
	12-45	30-35	1.40-1.60	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.28			
	45-50	10-25	1.30-1.45	0.6-2.0	0.15-0.22	6.6-7.8	Low----------	0.28			
	50-65	1-5	1.60-1.80	6.0-20	0.02-0.04	7.4-8.4	Low----------	0.10			
Mb---------------- Mahalasville	0-11	27-35	1.35-1.55	0.6-2.0	0.21-0.23	6.6-7.3	Moderate-----	0.28	5	7	3-5
	11-30	27-35	1.40-1.60	0.6-2.0	0.18-0.20	6.6-7.3	Moderate-----	0.43			
	30-47	18-30	1.40-1.70	0.6-2.0	0.15-0.19	6.6-7.8	Moderate-----	0.32			
	47-54	2-10	1.60-1.80	6.0-20	0.04-0.07	7.4-8.4	Low----------	0.10			
	54-60	12-20	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.37			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Mc:											
Mahalasville	0-11	17-27	1.30-1.45	0.2-0.6	0.22-0.24	6.6-7.3	Low	0.28	5	6	3-5
	11-29	27-35	1.40-1.60	0.6-2.0	0.18-0.20	6.6-7.3	Moderate	0.28			
	29-48	8-25	1.40-1.60	0.6-2.0	0.17-0.19	7.4-7.8	Low	0.28			
	48-60	3-18	1.50-1.70	0.6-2.0	0.19-0.21	7.9-8.4	Low	0.28			
Treaty	0-10	18-27	1.50-1.70	0.6-2.0	0.23-0.25	5.6-7.3	Low	0.32	5	6	4-6
	10-30	28-35	1.50-1.70	0.6-2.0	0.18-0.20	6.1-7.8	Moderate	0.43			
	30-48	20-35	1.50-1.70	0.6-2.0	0.15-0.19	6.6-7.8	Moderate	0.43			
	48-60	15-27	1.70-1.85	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.43			
MdB2:											
Martinsville	0-8	10-22	1.30-1.40	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.37	5	5	1-2
	8-35	22-31	1.40-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate	0.37			
	35-65	15-28	1.55-1.65	0.6-2.0	0.16-0.19	5.1-7.8	Moderate	0.37			
	65-70	8-15	1.65-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low	0.28			
Miami	0-8	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	4	5	.5-3
	8-35	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate	0.37			
	35-60	15-25	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Moderate	0.37			
MfC3:											
Martinsville	0-7	27-30	1.40-1.60	0.6-2.0	0.17-0.19	5.6-6.5	Moderate	0.37	4	6	.5-1
	7-40	22-31	1.40-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate	0.37			
	40-61	15-28	1.55-1.65	0.6-2.0	0.16-0.19	5.1-7.8	Moderate	0.37			
	61-70	8-15	1.65-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low	0.28			
Miami	0-6	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.37	3	6	.5-2
	6-25	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate	0.37			
	25-30	20-27	1.45-1.65	0.6-2.0	0.14-0.19	6.6-7.8	Low	0.37			
	30-60	15-25	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Moderate	0.37			
MhD3: Miami	0-6	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.37	3	6	.5-2
	6-26	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate	0.37			
	26-60	15-25	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Moderate	0.37			
MkB2:											
Miami	0-7	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	4	5	.5-3
	7-23	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate	0.37			
	23-31	20-27	1.45-1.65	0.6-2.0	0.14-0.19	6.6-7.8	Low	0.37			
	31-60	15-25	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Moderate	0.37			
Crosier	0-8	7-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.32	5	5	1-3
	8-36	20-33	1.40-1.60	0.2-0.6	0.15-0.19	5.1-7.3	Moderate	0.32			
	36-60	10-20	1.40-1.60	0.2-0.6	0.10-0.19	6.1-8.4	Low	0.32			
Mm: Milford	0-14	35-40	1.30-1.50	0.6-2.0	0.20-0.23	5.6-7.3	High	0.28	5	4	5-6
	14-60	35-42	1.40-1.60	0.2-0.6	0.18-0.20	5.6-7.8	Moderate	0.43			
	60-80	20-30	1.50-1.70	0.2-0.6	0.20-0.22	6.6-8.4	Moderate	0.43			
Mo: Milford	0-15	20-27	1.10-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	0.28	5	6	1-5
	15-68	35-42	1.40-1.60	0.2-0.6	0.18-0.20	5.6-7.8	Moderate	0.43			
	68-80	20-30	1.50-1.70	0.2-0.6	0.20-0.22	6.6-8.4	Moderate	0.43			
Mp: Milford	0-14	35-40	1.30-1.50	0.6-2.0	0.20-0.23	5.6-7.3	High	0.28	5	4	5-6
	14-70	35-42	1.45-1.55	0.2-0.6	0.18-0.20	5.6-7.8	Moderate	0.43			
	70-80	20-30	1.50-1.70	0.2-0.6	0.10-0.13	6.6-8.4	Moderate	0.43			
Mt: Millsdale	0-18	18-27	1.30-1.45	0.6-2.0	0.17-0.23	6.1-7.3	Low	0.32	4	6	4-6
	18-35	27-35	1.40-1.65	0.2-0.6	0.12-0.16	6.1-8.4	Moderate	0.32			
	35	---	---	---	---	---	---	---			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
MuB------------- Milton Variant	0-4	15-20	1.35-1.45	0.6-2.0	0.15-0.17	6.6-7.3	Low---------	0.28	2	8	1-3
	4-12	20-27	1.50-1.60	0.6-2.0	0.07-0.09	7.4-7.8	Low---------	0.32			
	12	---	---	---	---	---	------------	----			
Mv:											
Moundhaven------	0-14	2-10	1.40-1.50	6.0-20	0.10-0.12	7.4-8.4	Low---------	0.17	5	2	1-2
	14-38	1-8	1.50-1.65	6.0-20	0.06-0.11	7.4-8.4	Low---------	0.17			
	38-60	0-5	1.55-1.70	6.0-20	0.05-0.10	7.4-8.4	Low---------	0.17			
Landes Variant--	0-14	5-18	1.30-1.40	2.0-6.0	0.16-0.18	7.4-8.4	Low---------	0.20	4	3	2-4
	14-39	5-18	1.40-1.50	2.0-6.0	0.15-0.19	7.4-8.4	Low---------	0.24			
	39-60	5-15	1.50-1.70	2.0-6.0	0.08-0.10	7.9-8.4	Low---------	0.17			
MwB------------- Mudlavia	0-9	10-18	1.30-1.40	0.6-2.0	0.10-0.13	5.6-7.3	Low---------	0.17	2	8	1-3
	9-39	35-55	1.45-1.70	0.6-2.0	0.02-0.08	4.5-6.0	Moderate-----	0.28			
	39-45	45-55	1.45-1.70	0.6-2.0	0.02-0.08	6.1-7.3	Moderate-----	0.28			
	45-60	1-7	1.65-1.70	>20	0.01-0.03	7.4-8.4	Low---------	0.10			
MxA------------- Mudlavia Variant	0-7	10-26	1.35-1.45	0.6-2.0	0.15-0.19	6.1-7.3	Low---------	0.24	2	8	1-3
	7-21	35-40	1.55-1.65	0.6-2.0	0.08-0.12	6.1-7.3	Moderate-----	0.24			
	21-30	35-40	1.55-1.65	0.6-2.0	0.06-0.09	6.1-7.3	Moderate-----	0.24			
	30	---	---	---	---	---	------------	----			
OdA, OdB2-------- Ockley	0-9	11-22	1.30-1.40	0.6-2.0	0.20-0.24	5.6-6.5	Low---------	0.37	5	5	.5-3
	9-35	20-35	1.45-1.60	0.6-2.0	0.15-0.22	4.5-6.0	Moderate-----	0.37			
	35-56	20-35	1.40-1.55	0.6-2.0	0.06-0.11	5.6-6.5	Moderate-----	0.24			
	56-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low---------	0.10			
OfB2------------ Ockley	0-9	10-20	1.30-1.40	0.6-2.0	0.20-0.24	5.6-6.5	Low---------	0.37	5	5	1-2
	9-18	26-32	1.40-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.37			
	18-23	15-28	1.55-1.65	0.6-2.0	0.16-0.19	5.1-6.0	Moderate-----	0.37			
	23-57	15-25	1.60-1.70	0.6-2.0	0.12-0.15	6.1-7.8	Moderate-----	0.24			
	57-70	8-15	1.65-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low---------	0.24			
OgA:											
Ockley----------	0-9	10-20	1.30-1.40	0.6-2.0	0.20-0.24	5.6-6.5	Low---------	0.37	5	5	1-2
	9-18	26-32	1.40-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.37			
	18-23	15-28	1.55-1.65	0.6-2.0	0.16-0.19	5.1-6.0	Moderate-----	0.37			
	23-61	15-25	1.60-1.70	0.6-2.0	0.12-0.15	6.1-7.8	Moderate-----	0.24			
	61-70	8-15	1.65-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low---------	0.24			
Rush------------	0-9	12-20	1.25-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low---------	0.37	5	5	.5-2
	9-27	27-35	1.40-1.60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	27-33	18-35	1.50-1.70	0.6-2.0	0.15-0.19	5.1-6.5	Moderate-----	0.37			
	33-54	12-30	1.50-1.70	0.6-2.0	0.09-0.15	5.1-7.3	Moderate-----	0.24			
	54-58	2-10	1.60-1.80	>20	0.01-0.04	7.4-8.4	Low---------	0.10			
	58-65	12-20	1.70-1.90	0.6-2.0	0.05-0.10	7.4-8.4	Low---------	0.37			
OhC3:											
Ockley----------	0-7	27-30	1.40-1.70	0.6-2.0	0.17-0.19	5.6-6.5	Moderate-----	0.37	4	6	.5-1
	7-26	26-32	1.40-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.37			
	26-54	15-25	1.60-1.70	0.6-2.0	0.12-0.15	6.1-7.8	Moderate-----	0.24			
	54-60	8-15	1.65-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low---------	0.24			
Kendallville----	0-7	27-32	1.35-1.55	0.6-2.0	0.15-0.18	5.6-7.3	Moderate-----	0.37	5	6	.5-2
	7-26	23-38	1.40-1.65	0.6-2.0	0.12-0.16	4.5-7.8	Moderate-----	0.37			
	26-60	12-30	1.45-1.75	0.2-0.6	0.11-0.15	7.4-8.4	Low---------	0.37			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
OrA, OrB---------Ormas	0-9	5-12	1.40-1.60	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-3
	9-33	3-10	1.45-1.60	6.0-20	0.07-0.09	5.6-6.5	Low----------	0.17			
	33-40	10-25	1.50-1.70	2.0-6.0	0.12-0.14	5.1-6.5	Low----------	0.17			
	40-55	15-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.8	Low----------	0.32			
	55-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low----------	0.15			
Pb---------------Palms	0-19	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	5	2	>75
	19-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low----------	----			
Pd---------------Palms	0-42	---	0.25-0.45	0.6-6.0	0.35-0.45	7.4-7.8	-------------	----	5	2	>75
	42-60	18-26	1.50-1.70	0.6-2.0	0.07-0.09	7.4-7.8	Low----------	----			
Pe---------------Palms Variant	0-32	---	0.25-0.45	2.0-6.0	0.35-0.45	5.6-7.3	-------------	----	4	2	>75
	32-36	27-35	1.50-1.70	0.2-0.6	0.18-0.20	7.4-8.4	Moderate-----	0.43			
	36	---	---	---	---	---	-------------	----			
Pg---------------Patton	0-14	27-35	1.15-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Moderate-----	0.28	5	7	3-5
	14-54	27-35	1.25-1.45	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43			
	54-65	22-35	1.30-1.50	0.2-0.6	0.18-0.22	7.4-8.4	Moderate-----	0.43			
Pk---------------Pella	0-15	27-35	1.10-1.30	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28	5	7	5-6
	15-32	27-35	1.20-1.45	0.6-2.0	0.21-0.24	6.6-7.8	Moderate-----	0.28			
	32-47	15-30	1.35-1.60	0.6-2.0	0.15-0.20	7.4-8.4	Moderate-----	0.28			
	47-60	15-30	1.40-1.70	0.6-2.0	0.10-0.22	7.4-8.4	Low----------	0.28			
PnB--------------Piankeshaw Variant	0-8	7-18	1.30-1.40	2.0-6.0	0.10-0.13	7.4-8.4	Low----------	0.17	5	8	1-2
	8-45	7-18	1.40-1.50	2.0-6.0	0.03-0.04	7.4-8.4	Low----------	0.28			
	45-60	7-18	1.60-1.70	2.0-6.0	0.02-0.03	7.4-8.4	Low----------	0.17			
Pp, Pr. Pits											
RmB2, RmD2:											
Riddles----------	0-8	8-16	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	5	.5-2
	8-66	18-30	1.40-1.60	0.6-2.0	0.12-0.18	4.5-7.3	Moderate-----	0.32			
	66-80	8-15	1.45-1.65	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.32			
Miami------------	0-8	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.37	4	5	.5-3
	8-27	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate-----	0.37			
	27-32	20-27	1.45-1.65	0.6-2.0	0.14-0.19	6.6-7.8	Low----------	0.37			
	32-60	15-25	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Moderate-----	0.37			
RnC3:											
Riddles----------	0-7	8-16	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	4	5	.5-2
	7-62	18-30	1.40-1.60	0.6-2.0	0.12-0.18	4.5-7.3	Moderate-----	0.32			
	62-70	8-15	1.45-1.65	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.32			
Miami------------	0-6	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37	3	6	.5-2
	6-28	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate-----	0.37			
	28-60	15-25	1.70-1.90	0.06-0.2	0.05-0.10	7.4-8.4	Moderate-----	0.37			
RoA--------------Rockfield	0-9	12-24	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	5	5	1-2
	9-32	20-32	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	32-48	20-32	1.45-1.65	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.37			
	48-57	18-27	1.45-1.65	0.2-0.6	0.17-0.19	6.6-7.8	Moderate-----	0.37			
	57-65	12-20	1.70-1.90	0.2-0.6	0.05-0.10	7.9-8.4	Low----------	0.37			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
RrB2:											
Rockfield	0-9	12-24	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	5	5	1-2
	9-32	20-32	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.0	Moderate	0.37			
	32-48	20-32	1.45-1.65	0.6-2.0	0.15-0.19	5.1-7.3	Moderate	0.37			
	48-57	18-27	1.45-1.65	0.2-0.6	0.17-0.19	6.6-7.8	Moderate	0.37			
	57-65	12-20	1.70-1.90	0.2-0.6	0.05-0.10	7.9-8.4	Low	0.37			
Williamstown	0-9	14-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	4	5	1-3
	9-18	27-35	1.35-1.50	0.6-2.0	0.15-0.21	5.6-7.3	Moderate	0.37			
	18-30	18-27	1.35-1.50	0.6-2.0	0.15-0.19	6.1-7.8	Low	0.37			
	30-60	16-26	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.37			
Rt: Ross	0-28	8-20	1.20-1.40	0.6-2.0	0.12-0.18	6.1-7.8	Low	0.24	5	3	3-5
	28-68	18-32	1.20-1.50	0.6-2.0	0.16-0.22	6.1-8.4	Low	0.32			
	68-74	5-25	1.35-1.60	0.6-6.0	0.05-0.18	6.1-8.4	Low	0.32			
Ru: Ross	0-29	15-27	1.20-1.45	0.6-2.0	0.19-0.24	6.1-7.8	Low	0.32	5	5	3-5
	29-66	18-32	1.20-1.50	0.6-2.0	0.16-0.22	6.1-8.4	Low	0.32			
	66-80	5-30	1.35-1.60	0.6-6.0	0.05-0.18	6.1-8.4	Low	0.32			
RwA: Rush	0-9	10-20	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	5	.5-2
	9-29	22-30	1.35-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate	0.37			
	29-35	20-30	1.40-1.55	0.6-2.0	0.15-0.19	4.5-6.5	Moderate	0.37			
	35-49	15-25	1.40-1.55	0.6-2.0	0.10-0.16	5.1-7.3	Low	0.24			
	49-56	8-10	1.40-1.55	0.6-2.0	0.04-0.10	6.6-7.8	Low	0.24			
	56-65	2-6	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low	0.10			
Sn, So: Sloan	0-12	15-27	1.20-1.40	0.6-2.0	0.19-0.24	6.1-7.8	Low	0.28	5	6	3-6
	12-57	22-35	1.25-1.55	0.6-2.0	0.15-0.19	6.1-8.4	Moderate	0.37			
	57-60	10-30	1.20-1.50	0.6-2.0	0.13-0.18	6.6-8.4	Low	0.37			
Ss: Sloan	0-15	15-20	1.25-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.28	4	5	3-5
	15-29	22-27	1.40-1.55	0.6-2.0	0.17-0.19	6.1-7.3	Moderate	0.28			
	29-48	22-27	1.40-1.55	0.6-2.0	0.17-0.19	6.6-7.8	Moderate	0.28			
	48	---	---	---	---	---	---	---			
StA: Starks	0-9	18-27	1.15-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	6	1-3
	9-39	27-35	1.35-1.55	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.37			
	39-63	18-30	1.45-1.65	0.6-2.0	0.16-0.19	5.1-7.8	Moderate	0.37			
	63-80	5-20	1.55-1.75	0.6-2.0	0.08-0.18	5.1-7.8	Low	0.37			
Ud. Udorthents											
Wd: Wallkill	0-9	10-27	1.15-1.40	0.6-2.0	0.16-0.21	5.1-7.8	Low	0.37	5	---	2-4
	9-28	15-27	1.15-1.40	0.6-2.0	0.15-0.20	5.1-7.8	Low	0.32			
	28-60	---	0.25-0.45	2.0-20	0.35-0.45	5.6-7.8	---	---			
We: Warners Variant	0-8	10-18	1.30-1.40	0.2-0.6	0.22-0.24	7.9-8.4	Low	0.28	4	4L	4-6
	8-30	10-18	1.40-1.50	0.2-0.6	0.20-0.24	7.9-8.4	Low	0.28			
	30-60	---	---	---	---	7.9-8.4	---	---			
Wk: Washtenaw	0-13	15-27	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.37	5	5	3-7
	13-27	15-27	1.30-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.37			
	27-80	20-35	1.40-1.60	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	0.37			
WoA: Waynetown	0-9	10-20	1.30-1.55	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	5	.5-2
	9-32	27-34	1.55-1.65	0.6-2.0	0.18-0.22	5.6-6.5	Moderate	0.37			
	32-37	20-27	1.40-1.65	0.6-2.0	0.13-0.17	5.6-6.5	Moderate	0.37			
	37-54	20-30	1.50-1.65	0.6-2.0	0.06-0.13	6.6-7.8	Moderate	0.28			
	54-60	1-5	1.60-1.85	>20	0.02-0.04	7.9-8.4	Low	0.10			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
WpA:											
Waynetown	0-10	12-20	1.25-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	5	5	.5-2
	10-34	27-35	1.40-1.60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.37			
	34-42	18-27	1.50-1.70	0.6-2.0	0.15-0.19	5.6-6.5	Moderate	0.28			
	42-58	12-30	1.50-1.70	0.6-2.0	0.12-0.15	5.6-7.8	Moderate	0.28			
	58-60	12-20	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.37			
Sleeth	0-8	12-20	1.25-1.45	0.6-2.0	0.22-0.24	6.6-7.3	Low	0.37	5	5	.5-2
	8-18	27-35	1.40-1.60	0.6-2.0	0.18-0.20	5.6-6.5	Moderate	0.37			
	18-34	27-35	1.50-1.70	0.6-2.0	0.15-0.19	5.6-6.5	Moderate	0.37			
	34-48	12-30	1.50-1.70	0.6-2.0	0.09-0.15	5.6-7.3	Moderate	0.24			
	48-56	2-10	1.60-1.80	>20	0.01-0.04	7.4-8.4	Low	0.10			
	56-60	12-20	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.37			
Wr Westland	0-10	15-27	1.30-1.40	0.6-2.0	0.20-0.24	6.1-7.3	Low	0.28	5	6	2-6
	10-44	20-35	1.40-1.65	0.6-2.0	0.15-0.20	6.1-7.3	Moderate	0.28			
	44-51	5-30	1.55-1.70	0.6-2.0	0.04-0.13	6.6-7.8	Low	0.28			
	51-60	1-10	1.65-1.95	>20	0.01-0.04	7.4-8.4	Low	0.10			
Ws Westland	0-13	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.24	5	5	4-6
	13-35	27-34	1.50-1.70	0.6-2.0	0.15-0.19	6.1-7.3	Moderate	0.32			
	35-58	5-15	1.60-1.70	0.6-6.0	0.04-0.10	7.4-8.4	Low	0.17			
	58-60	---	---	---	---	---	------------	----			
WvB2 Williamstown	0-9	14-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	4	5	1-3
	9-30	27-35	1.35-1.50	0.6-2.0	0.15-0.21	5.6-7.3	Moderate	0.37			
	30-34	18-27	1.35-1.50	0.6-2.0	0.15-0.19	6.1-7.8	Low	0.37			
	34-60	16-26	1.70-1.90	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.37			

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AsB2 Alvin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
At Armiesburg	B	Occasional	Brief	Dec-Jun	>6.0	---	---	>60	---	High	Moderate	Low.
Ba Beaucoup	B/D	Rare	Brief	Dec-Apr	+.5-2.0	Apparent	Dec-Jun	>60	---	High	High	Low.
Bb Beaucoup	B/D	Frequent	Brief	Dec-Jun	+.5-2.0	Apparent	Dec-Jun	>60	---	High	High	Low.
CaA, CaB2 Camden	B	None	---	---	>6.0	---	---	>60	---	High	Low	Moderate.
CeG:												
Casco	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Hennepin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Cg Ceresco	B	Occasional	Brief	Dec-May	1.0-2.0	Apparent	Dec-May	>60	---	High	Low	Low.
Ck Ceresco Variant	B	Occasional	Brief	Dec-Apr	1.0-2.0	Apparent	Dec-Jun	>60	---	High	Moderate	Low.
Cn Cohoctah	B/D	Occasional	Brief	Nov-Apr	0-1.0	Apparent	Nov-May	>60	---	High	High	Low.
Cp Cohoctah	B/D	Occasional	Brief	Nov-Dec	+.5-1.0	Apparent	Nov-May	>60	---	High	High	Low.
Cr Cohoctah Variant	B	Frequent	Brief	Nov-May	+.5-1.0	Apparent	Nov-Jun	>60	---	High	High	Low.
CtB Coloma	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
CvA Crosby	C	None	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High	High	Moderate.
CwB:												
Crosby	C	None	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High	High	Moderate.
Fincastle	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
CyB:												
Crosier	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Low.
Whitaker	C	None	---	---	1.0-3.0	Apparent	Dec-May	>60	---	High	High	Moderate.
Cz Cyclone	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
FaA, FbB:												
Fincastle	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.
Starks	C	None	---	---	1.0-3.0	Apparent	Jan-Jun	>60	---	High	High	Moderate.
FsA, FsB2 Fox	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
FtC3 Fox	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
HkG Hennepin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
HnG:												
Hennepin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Rock outcrop.												
Hw Houghton	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	High	High	Low.
Jr Jules	B	Frequent	Long	Dec-Jun	>6.0	---	---	>60	---	High	Low	Low.
Js:												
Jules	B	Frequent	Brief	Dec-Jun	>6.0	---	---	>60	---	High	Low	Low.
Stonelick	B	Frequent	Brief	Dec-Jun	>6.0	---	---	>60	---	Moderate	Low	Low.
KcA, KcB2 Kalamazoo	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
KfA Kendall	B	None	---	---	1.0-3.0	Apparent	Dec-Jun	>60	---	High	High	Moderate.
KgA:												
Kendall	B	None	---	---	1.0-3.0	Apparent	Dec-Jun	>60	---	High	High	Moderate.
Fincastle	C	None	---	---	1.0-3.0	Apparent	Dec-Apr	>60	---	High	High	Moderate.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ld----------------- Landes	B	Rare---------	Brief------	Jan-May	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Lo----------------- Landes	B	Occasional	Brief------	Jan-May	4.0-6.0	Apparent	Mar-May	>60	---	Moderate	Low-------	Low.
Ls:												
Landes------------	B	Occasional	Brief------	Jan-May	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Moundhaven--------	A	Occasional	Brief------	Jan-May	>6.0	---	---	>60	---	Low-------	Low-------	Low.
Ma----------------- Mahalasville	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High------	High------	Low.
Mb----------------- Mahalasville	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-Jun	>60	---	High------	High------	Low.
Mc:												
Mahalasville------	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High------	High------	Low.
Treaty------------	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High------	High------	Low.
MdB2, MfC3:												
Martinsville------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Miami-------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MhD3--------------- Miami	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MkB2:												
Miami-------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Crosier-----------	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High------	High------	Low.
Mm, Mo------------- Milford	B/D	None---------	---	---	+.5-2.0	Apparent	Nov-Jun	>60	---	High------	High------	Low.
Mp----------------- Milford	B/D	Occasional	Brief------	Nov-Jun	0-2.0	Apparent	Nov-Jun	>60	---	High------	High------	Low.
Mt----------------- Millsdale	B/D	None---------	---	---	+1-1.0	Perched	Nov-Apr	20-40	Hard	High------	High------	Low.
MuB---------------- Milton Variant	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	Low-------	Low.
Mv:												
Moundhaven--------	A	Frequent-----	Brief------	Dec-May	>6.0	---	---	>60	---	Low-------	Low-------	Low.
Landes Variant----	B	Frequent-----	Brief------	Dec-May	>6.0	---	---	>60	---	Moderate	Low-------	Low.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
MwB: Mudlavia	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	High.
MxA: Mudlavia Variant	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	Low.
OdA, OdB2, OfB2: Ockley	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
OgA:												
Ockley	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Rush	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
OhC3:												
Ockley	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Kendallville	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
OrA, OrB: Ormas	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
Pb: Palms	A/D	None	---	---	+1-1.0	Apparent	Nov-May	>60	---	High	High	Moderate.
Pd: Palms	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	High	High	High.
Pe: Palms Variant	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	20-40	Hard	High	High	Moderate.
Pg: Patton	B/D	None	---	---	+.5-2.0	Apparent	Dec-Jun	>60	---	High	High	Low.
Pk: Pella	B/D	None	---	---	+.5-2.0	Apparent	Dec-Jun	>60	---	High	High	Low.
PnB: Piankeshaw Variant	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Pp, Pr. Pits												
RmB2, RmD2, RnC3:												
Riddles	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Miami	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
RoA: Rockfield	B	None	---	---	2.5-4.0	Apparent	Dec-Apr	>60	---	High	High	Moderate.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
RrB2:												
Rockfield	B	None	---	---	2.5-4.0	Apparent	Dec-Apr	>60	---	High	High	Moderate.
Williamstown	C	None	---	---	1.5-3.5	Perched	Jan-Apr	>60	---	High	Moderate	Low.
Rt, Ru Ross	B	Rare	Brief	Jan-May	>6.0	---	---	>60	---	Moderate	Low	Low.
RwA Rush	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
Sn Sloan	B/D	Rare	Brief	Dec-May	0-1.0	Apparent	Nov-Jun	>60	---	High	High	Low.
So Sloan	B/D	Occasional	Brief	Nov-Jun	0-1.0	Apparent	Nov-Jun	>60	---	High	High	Low.
Ss Sloan	B/D	Occasional	Brief	Dec-Jun	+.5-1.0	Apparent	Dec-Jun	40-60	Hard	High	High	Low.
StA Starks	C	None	---	---	1.0-3.0	Apparent	Dec-Jun	>60	---	High	High	Moderate.
Ud. Udorthents												
Wd Wallkill	B/D	None	---	---	+.5-1.0	Apparent	Sep-Jun	>60	---	High	Moderate	Moderate.
We Warners Variant	B	None	---	---	0-1.0	Apparent	Sep-Jun	>60	---	High	High	Low.
Wk Washtenaw	C/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
WoA Waynetown	C	None	---	---	1.0-3.0	Apparent	Jan-May	>60	---	High	High	Moderate.
WpA:												
Waynetown	C	None	---	---	1.0-3.0	Apparent	Dec-Jun	>60	---	High	High	Moderate.
Sleeth	C	None	---	---	1.0-3.0	Apparent	Dec-Jun	>60	---	High	High	Moderate.
Wr Westland	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
Ws Westland	B/D	None	---	---	+.5-1.0	Apparent	Nov-Jun	40-60	Hard	High	High	Low.
WvB2 Williamstown	C	None	---	---	1.5-3.5	Perched	Jan-Apr	>60	---	High	Moderate	Low.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available. MAX means maximum dry density; OPT, optimum moisture; LL, liquid limit; PI, plasticity index; and UN, Unified)

Soil name and location	Parent material	Report number S84-IN-15	Depth	Moisture density		Percentage passing sieve--				Percentage smaller than--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	UN
			In	Lb/cu ft	Pct									Pct			
Cyclone silty clay loam: 2,325 feet east and 125 feet north of the southwest corner of sec. 28, T. 24 N., R. 2 W.	About 55 inches of silty material over glacial till.	2-1	0-12	109	16	99	99	97	84	---	---	---	19	30	10	A-4	CL
		2-5	17-35	105	19	98	98	97	87	---	---	---	32	45	26	A-7-6	CL
		2-9	55-59	114	15	96	96	94	67	---	---	---	23	33	17	A-6	CL
		2-11	68-80	122	12	95	95	87	61	---	---	---	18	20	4	A-4	CL-ML
Miami clay loam: 1,835 feet west and 2,100 feet south of the northeast corner of sec. 10, T. 26 N., R. 2 W.	Loamy glacial till.	11-1	0-8	113	15	98	98	95	67	---	---	---	18	27	8	A-4	CL
		11-4	16-28	112	16	97	97	93	68	---	---	---	19	34	17	A-6	CL
		11-6	36-60	126	11	95	95	91	61	---	---	---	19	21	5	A-4	CL-ML
Starks silt loam: 1,950 feet east and 2,100 feet north of the southwest corner of sec. 19, T. 24 N., R. 1 W.	About 35 inches of silty material over glacial outwash.	7-1	0-10	107	18	99	99	99	96	---	---	---	30	32	11	A-6	CL
		7-3	16-28	105	17	100	100	100	97	---	---	---	33	42	23	A-7-6	CL
		7-6	35-46	123	12	95	95	90	82	---	---	---	18	25	9	A-4	CL
		7-9	50-60	125	11	96	96	91	67	---	---	---	14	20	5	A-4	CL-ML

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alvin	Coarse-loamy, mixed, mesic Typic Hapludalfs
Armiesburg	Fine-silty, mixed, mesic Fluventic Hapludolls
Beaucoup	Fine-silty, mixed, mesic Fluvaquentic Haplaquolls
Camden	Fine-silty, mixed, mesic Typic Hapludalfs
Casco	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Ceresco	Coarse-loamy, mixed, mesic Fluvaquentic Hapludolls
Ceresco Variant	Coarse-loamy, mixed, mesic Fluvaquentic Hapludolls
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Cohoctah Variant	Coarse-loamy, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Coloma	Mixed, mesic Alfic Udipsamments
Crosby	Fine, mixed, mesic Aeric Ochraqualfs
Crosier	Fine-loamy, mixed, mesic Aeric Ochraqualfs
*Cyclone	Fine-silty, mixed, mesic Typic Argiaquolls
Fincastle	Fine-silty, mixed, mesic Aeric Ochraqualfs
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Hennepin	Fine-loamy, mixed, mesic Typic Eutrochrepts
Houghton	Euic, mesic Typic Medisaprists
Jules	Coarse-silty, mixed (calcareous), mesic Typic Udifluvents
Kalamazoo	Fine-loamy, mixed, mesic Typic Hapludalfs
Kendall	Fine-silty, mixed, mesic Aeric Ochraqualfs
Kendallville	Fine-loamy, mixed, mesic Typic Hapludalfs
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Landes Variant	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Mahalasville	Fine-silty, mixed, mesic Typic Argiaquolls
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Miami	Fine-loamy, mixed, mesic Typic Hapludalfs
Milford	Fine, mixed, mesic Typic Haplaquolls
*Millsdale	Fine, mixed, mesic Typic Argiaquolls
Milton Variant	Loamy-skeletal, mixed, mesic Lithic Hapludalfs
Moundhaven	Sandy, mixed, mesic Typic Udifluvents
Mudlavia	Clayey-skeletal, mixed, mesic Typic Hapludalfs
Mudlavia Variant	Clayey-skeletal, mixed, mesic Typic Hapludalfs
Ockley	Fine-loamy, mixed, mesic Typic Hapludalfs
Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Palms Variant	Loamy, mixed, euic, mesic Terric Medisaprists
Patton	Fine-silty, mixed, mesic Typic Haplaquolls
Pella	Fine-silty, mixed, mesic Typic Haplaquolls
Piankeshaw Variant	Loamy-skeletal, mixed (calcareous), mesic Typic Udifluvents
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
Rockfield	Fine-silty, mixed, mesic Typic Hapludalfs
Ross	Fine-loamy, mixed, mesic Cumulic Hapludolls
Rush	Fine-silty, mixed, mesic Typic Hapludalfs
Sleeth	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Starks	Fine-silty, mixed, mesic Aeric Ochraqualfs
Stonelick	Coarse-loamy, mixed (calcareous), mesic Typic Udifluvents
Treaty	Fine-silty, mixed, mesic Typic Argiaquolls
Udorthents	Loamy, mixed, mesic Typic Udorthents
Wallkill	Fine-loamy, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Warners Variant	Coarse-silty, carbonatic, mesic Fluvaquentic Haplaquolls
*Washtenaw	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Waynetown	Fine-silty, mixed, mesic Aeric Ochraqualfs
Westland	Fine-loamy, mixed, mesic Typic Argiaquolls
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Williamstown	Fine-loamy, mixed, mesic Aquic Hapludalfs

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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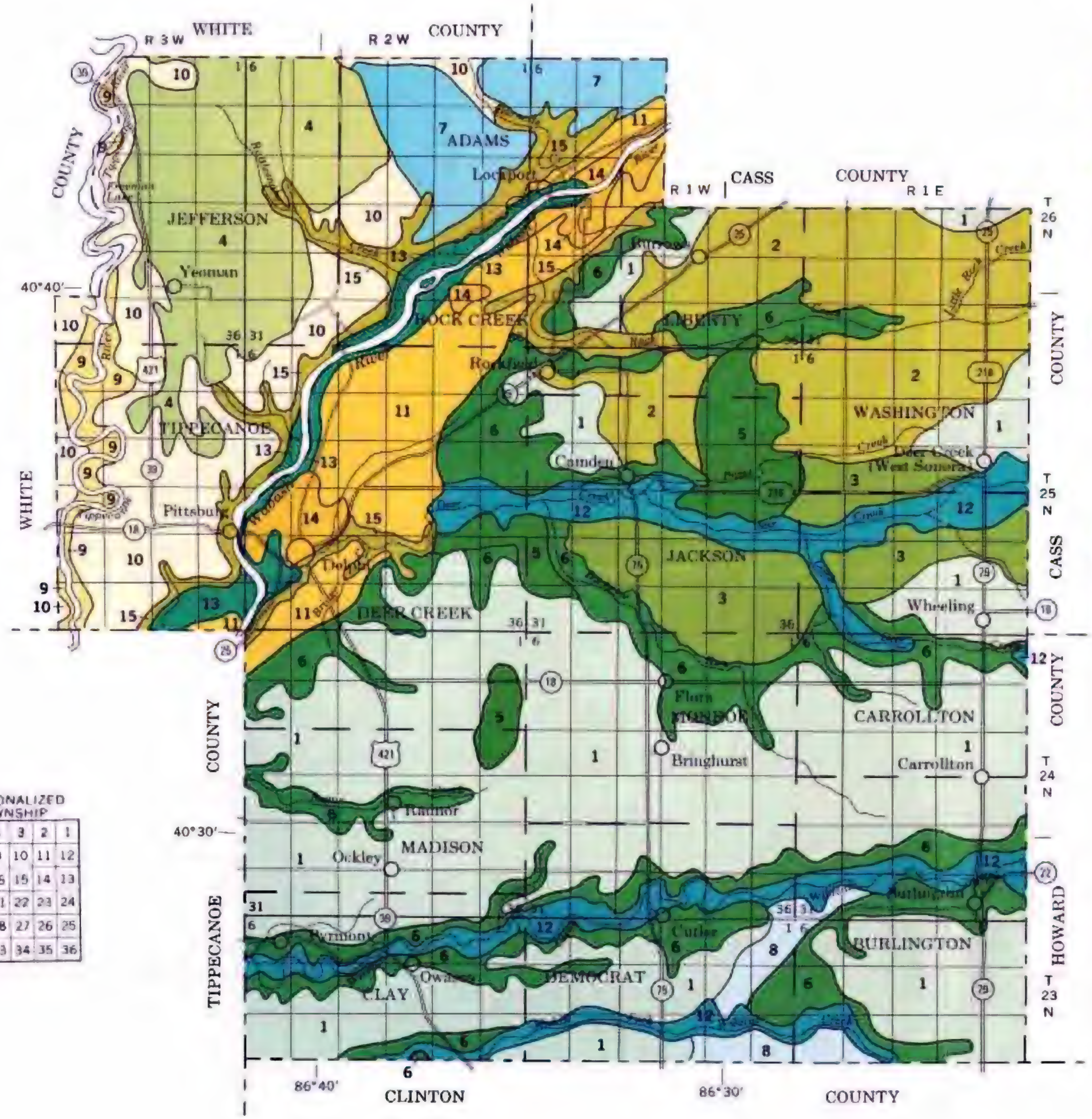

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

NEARLY LEVEL AND GENTLY SLOPING SOILS THAT ARE VERY POORLY DRAINED TO WELL DRAINED; ON TILL PLAINS AND OUTWASH PLAINS

1 CYCLONE-FINCASTLE STARKS: Deep, nearly level and gently sloping, poorly drained and somewhat poorly drained, moderately fine textured and medium textured soils that formed in silty material over calcareous glacial till or glacial outwash; on till plains and outwash plains

2 CYCLONE-KENDALL-FINCASTLE: Deep, nearly level, poorly drained and somewhat poorly drained, moderately fine textured and medium textured soils that formed in silty material over glacial till or glacial outwash; on till plains and outwash plains

STARKS-PATTON: Deep, nearly level, somewhat poorly drained and poorly drained, medium textured and moderately fine textured soils that formed in silty material or in silty material over glacial outwash, on outwash plains

4 MAHALASVILLE, TILL SUBSTRATUM-WAYNETOWN, TILL SUBSTRATUM-SLEETH: Deep, nearly level, very poorly drained and somewhat poorly drained, medium textured and moderately fine textured soils that formed in silty material and loamy glacial outwash over glacial till; on outwash plains

CAMDEN-KENDALL-PATTON: Deep, nearly level and gently sloping, well drained, somewhat poorly drained, and poorly drained, medium textured and moderately fine textured soils that formed in silty material and glacial outwash; on outwash plains

ROCKFIELD-FINCASTLE-STARKS: Deep, nearly level and gently sloping, moderately well drained and somewhat poorly drained, medium textured soils that formed in silty material over glacial outwash or glacial till; on till plains

NEARLY LEVEL TO MODERATELY STEEP SOILS THAT ARE WELL DRAINED AND SOMEWHAT POORLY DRAINED; ON TILL PLAINS

7 RIDDLES-MIAMI-CROSIER: Deep, nearly level to moderately steep, well drained and somewhat poorly drained, medium textured and moderately fine textured soils that formed in glacial till; on till plains

8 MARTINSVILLE, TILL SUBSTRATUM-MIAMI-CROSBY: Deep, nearly level to moderately steep, well drained and somewhat poorly drained, medium textured soils that formed in loamy glacial outwash over glacial till, in glacial till, or in silty material over glacial till; on till plains

NEARLY LEVEL TO STRONGLY SLOPING SOILS THAT ARE WELL DRAINED AND EXCESSIVELY DRAINED; ON TERRACES

9 ORMAS-FOX-COLOMA: Deep, nearly level to strongly sloping, well drained and excessively drained, coarse textured, moderately coarse textured, and moderately fine textured soils that formed in sandy sediments or in loamy sediments that are moderately deep over sand and very gravelly coarse sand; on terraces

NEARLY LEVEL TO STRONGLY SLOPING SOILS THAT ARE WELL DRAINED; ON OUTWASH PLAINS AND TERRACES

10 OCKLEY, TILL SUBSTRATUM-KALAMAZOO-RUSH, TILL SUBSTRATUM: Deep, nearly level and gently sloping, well drained, medium textured soils that formed in silty material and loamy glacial outwash over sand and very gravelly coarse sand; on outwash plains

11 OCKLEY-FOX-MUDLAVIA: Deep, nearly level to strongly sloping, well drained, medium textured, moderately coarse textured, and moderately fine textured soils that formed in silty sediments and in loamy sediments that are moderately deep over sand and very gravelly coarse sand; on terraces

NEARLY LEVEL AND GENTLY SLOPING SOILS THAT ARE MODERATELY WELL DRAINED TO SOMEWHAT EXCESSIVELY DRAINED; ON FLOOD PLAINS AND TERRACES

MOUNDHAVEN-LANDES-OCKLEY: Deep, nearly level and gently sloping, somewhat excessively drained to moderately well drained, coarse textured to medium textured soils that formed in sandy and loamy alluvium or in silty sediments and glacial outwash; on flood plains and terraces

JULES-LANDES-ARMIESBURG: Deep, nearly level, well drained, moderately fine textured to moderately coarse textured soils that formed in silty and loamy sediments; on flood plains

NEARLY LEVEL AND GENTLY SLOPING SOILS THAT ARE WELL DRAINED AND VERY POORLY DRAINED; ON TERRACES

14 MILTON VARIANT-MILLSDALE-MUDLAVIA VARIANT: Shallow and moderately deep, nearly level and gently sloping, well drained and very poorly drained, medium textured soils that formed in silty residuum and in loamy and clayey-skeletal glacial outwash over bedrock; on terraces

STEEP AND VERY STEEP SOILS THAT ARE WELL DRAINED; ON BREAKS OF TILL PLAINS, OUTWASH PLAINS, AND TERRACES

15 HENNEPIN-CASCO: Deep, steep and very steep, well drained, medium textured soils that formed in glacial till or glacial outwash; on breaks of till plains, outwash plains, and terraces

* Unless otherwise indicated, the texture terms in the descriptive headings refer to the surface layer of the major soils in the map units

Compiled 1987

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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES
STATE SOIL CONSERVATION BOARD
DIVISION OF SOIL CONSERVATION

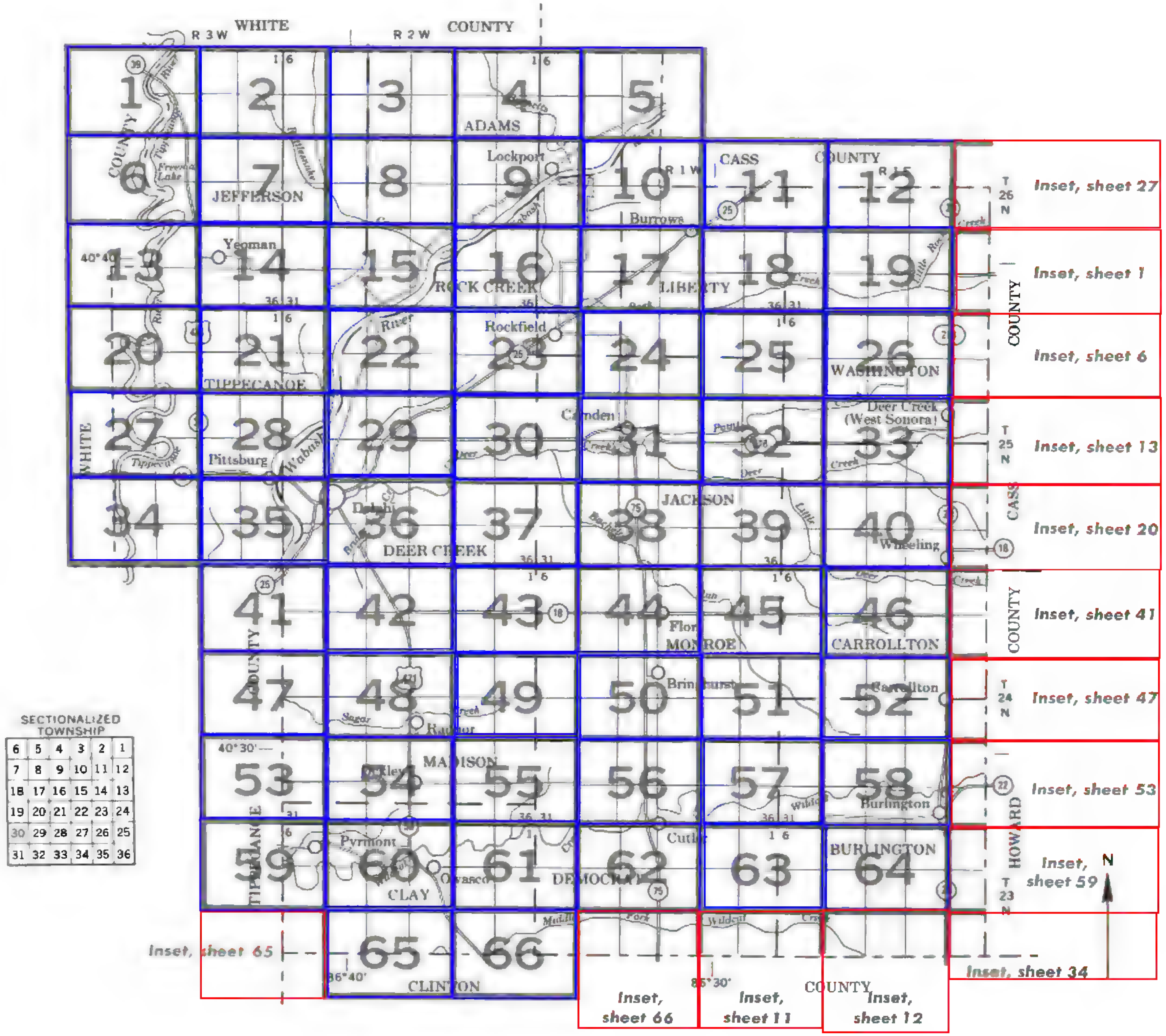
GENERAL SOIL MAP

CARROLL COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 Mi

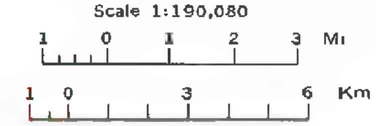
1 0 3 6 Km



INDEX TO MAP SHEETS

CARROLL COUNTY, INDIANA

Scale 1:190,080



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CARROLL COUNTY, INDIANA

PURDUE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES
STATE SOIL CONSERVATION BOARD
DIVISION OF SOIL CONSERVATION

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

SYMBOL	NAME
AsB2	Alvin fine sandy loam, 2 to 8 percent slopes, eroded
At	Armiesburg silty clay loam, occasionally flooded
Ba	Beaucoup silty clay loam, rarely flooded
[illegible]	Beaucoup silt loam, frequently flooded
CaA	Camden silt loam, 0 to 1 percent slopes
CaB2	Camden silt loam, 2 to 6 percent slopes, eroded
CeG	Casco-Hennepin loams, 30 to 70 percent slopes
Cg	Ceresco fine sandy loam, occasionally flooded
Ck	Ceresco Variant fine sandy loam, occasionally flooded
Cn	Cohoctah loam, occasionally flooded
Cp	Cohoctah loam, gravelly substratum, occasionally flooded
Cr	Cohoctah Variant very fine sandy loam, frequently flooded
CtB	Coloma loamy sand, 2 to 10 percent slopes
CvA	Crosby silt loam, 0 to 2 percent slopes
CwB	Crosby-Fincastle silt loams, 1 to 3 percent slopes
CyB	Crosier-Whitaker, till substratum, complex, 1 to 3 percent slopes
Cz	Cyclone silty clay loam
FaA	Fincastle-Starks silt loams, 0 to 1 percent slopes
FbB	Fincastle-Starks silt loams, 1 to 3 percent slopes
FeA	Fox sandy loam, 0 to 2 percent slopes
FsB2	Fox sandy loam, 2 to 6 percent slopes, eroded
FtC3	Fox gravelly clay loam, 6 to 15 percent slopes, severely eroded
HkG	Hennepin loam, 30 to 70 percent slopes
HnG	Hennepin-Rock outcrop complex, 30 to 90 percent slopes
Hw	Houghton muck, drained
Jr	Jules silt loam, frequently flooded
Js	Jules-Stonelick complex, frequently flooded
KcA	Kalamazoo loam, 0 to 2 percent slopes
KcB2	Kalamazoo loam, 2 to 6 percent slopes, eroded
KfA	Kendall silt loam, 0 to 1 percent slopes
KgA	Kendall-Fincastle silt loams, 0 to 1 percent slopes
Ld	Landes fine sandy loam, rarely flooded
Lo	Landes loam, moderately wet, occasionally flooded
Ls	Landes-Moundhaven complex, occasionally flooded

SYMBOL	NAME
Ma	Mahalasville silty clay loam, gravelly substratum
Mb	Mahalasville silty clay loam, till substratum
Mc	Mahalasville-Treaty silt loams
MdB2	Martinsville, till substratum-Miami loams, 2 to 6 percent slopes, eroded
MfC3	Martinsville, till substratum-Miami clay loams, 6 to 12 percent slopes, severely eroded
MhD3	Miami clay loam, 15 to 20 percent slopes, severely eroded
MkB2	Miami-Crosier complex, 2 to 6 percent slopes, eroded
Mm	Milford silty clay loam
Mo	Milford silt loam, pothole
Mp	Milford silty clay loam, occasionally flooded
Mt	Millsdale loam
MuB	Milton Variant channery silt loam, 1 to 4 percent slopes, flaggy
Mv	Moundhaven-Landes Variant complex, frequently flooded
MwB	Mudlavia gravelly sandy loam, 1 to 3 percent slopes
MxA	Mudlavia Variant gravelly loam, 0 to 2 percent slopes
OdA	Ockley silt loam, 0 to 2 percent slopes
OdB2	Ockley silt loam, 2 to 6 percent slopes, eroded
OfB2	Ockley loam, till substratum, 2 to 6 percent slopes, eroded
OgA	Ockley-Rush silt loams, till substrata, 0 to 2 percent slopes
OhC3	Ockley, till substratum-Kendallville clay loams, 6 to 12 percent slopes, severely eroded
OrA	Ormas loamy sand, 0 to 2 percent slopes
OrB	Ormas loamy sand, 2 to 6 percent slopes
Pb	Palms muck, drained
Pd	Palms muck, cobbly substratum, drained
Pe	Palms Variant muck, drained
Pg	Patton silty clay loam
Pk	Pella silty clay loam
PnB	Piankeshaw Variant gravelly sandy loam, rarely flooded, 2 to 8 percent slopes
Pp	Pits, gravel
Pr	Pits, quarry
RmB2	Riddles-Miami loams, 2 to 6 percent slopes, eroded
RmD2	Riddles-Miami loams, 12 to 18 percent slopes, eroded
RnC3	Riddles-Miami complex, 6 to 12 percent slopes, severely eroded
RoA	Rockfield silt loam, 0 to 2 percent slopes
RrB2	Rockfield-Williamstown complex, 1 to 6 percent slopes, eroded
Rt	Ross fine sandy loam, protected
Ru	Ross loam, rarely flooded
RwA	Rush silt loam, 0 to 2 percent slopes
Sn	Sloan silt loam, rarely flooded
So	Sloan silt loam, occasionally flooded
Ss	Sloan silt loam, bedrock substratum, occasionally flooded
StA	Starks silt loam, 0 to 1 percent slopes
Ud	Udorthents, loamy
Wd	Wallkill silt loam
We	Warners Variant silt loam, 2 to 8 percent slopes, undrained
Wk	Washtenaw silt loam
WoA	Waynetown silt loam, 0 to 2 percent slopes
WpA	Waynetown-Sleeth silt loams, till substrata, 0 to 1 percent slopes
Wr	Westland loam
Ws	Westland loam, shale substratum
WvB2	Williamstown silt loam, 2 to 6 percent slopes, eroded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Swift Airport; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — Bb; Cg

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

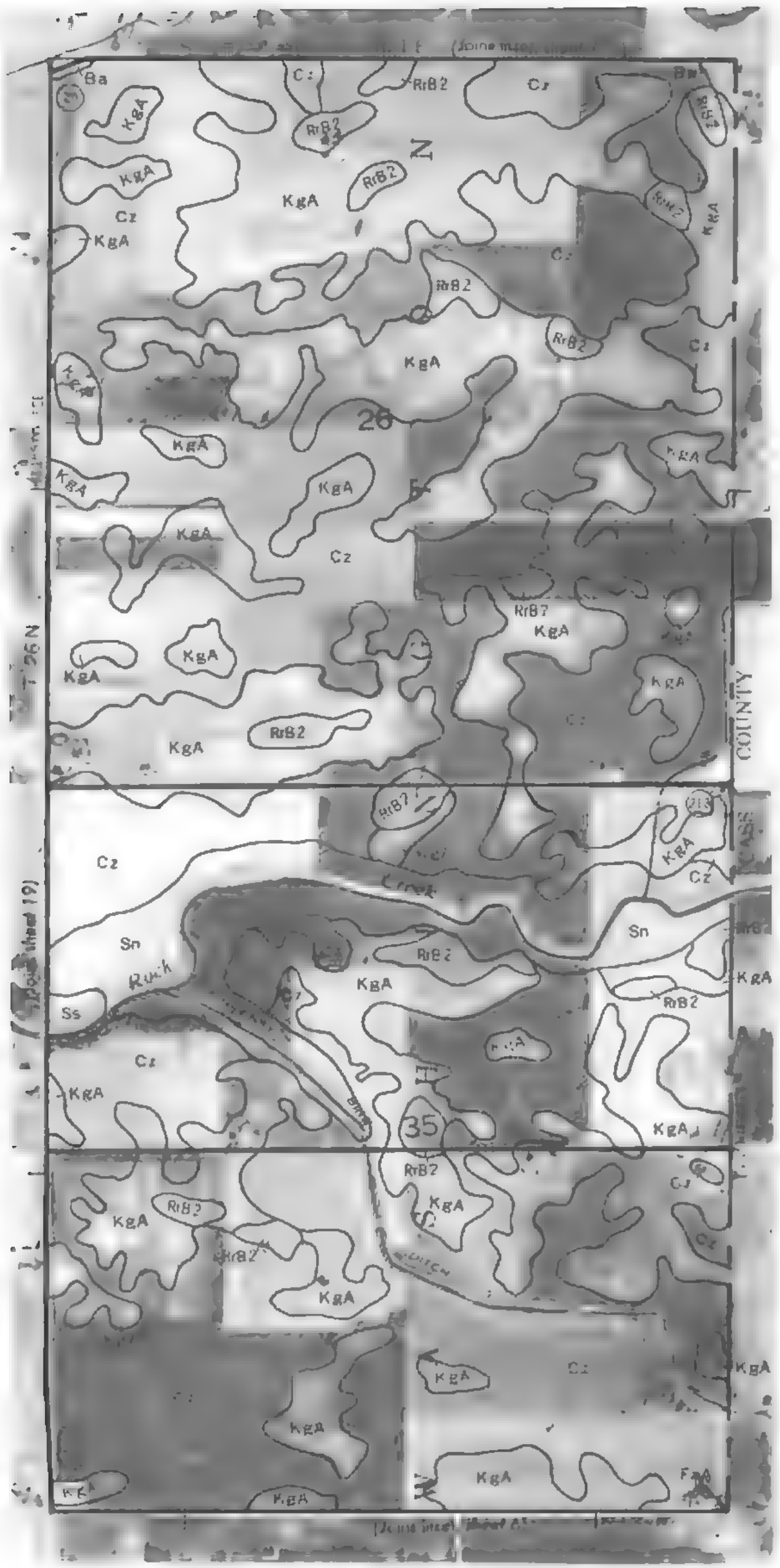
SOIL SAMPLE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Overwash spot
- Limestone bedrock within 40-60 inches
- Cobbly spot
- Shale bedrock within 20-40 inches
- Organic spot muck <16" thick
- Channery spot

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 1

INSET



1000 AND 5000-FOOT GRID TICKS

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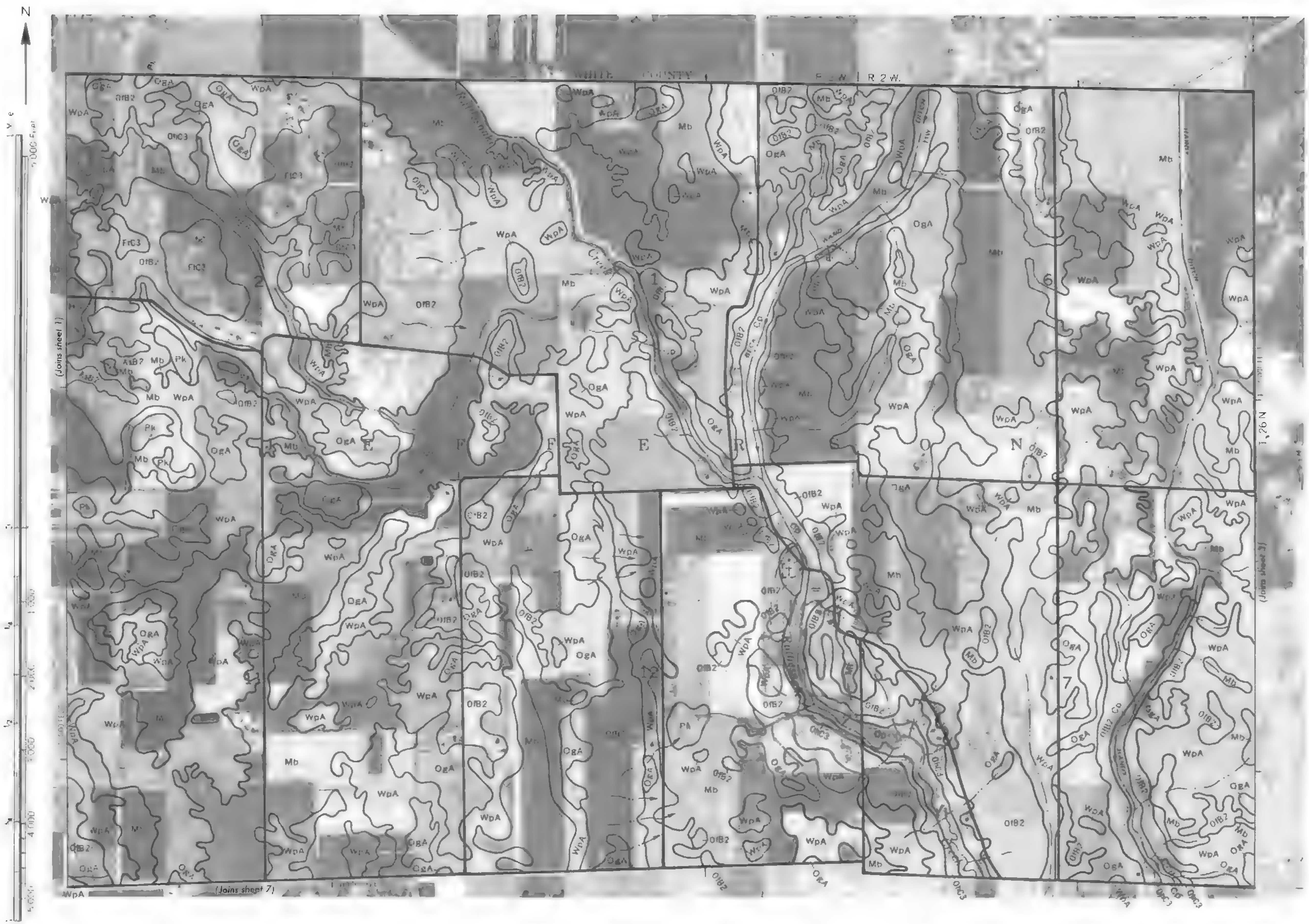
CARROLL COUNTY, INDIANA NO. 1

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 2



SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 3

3

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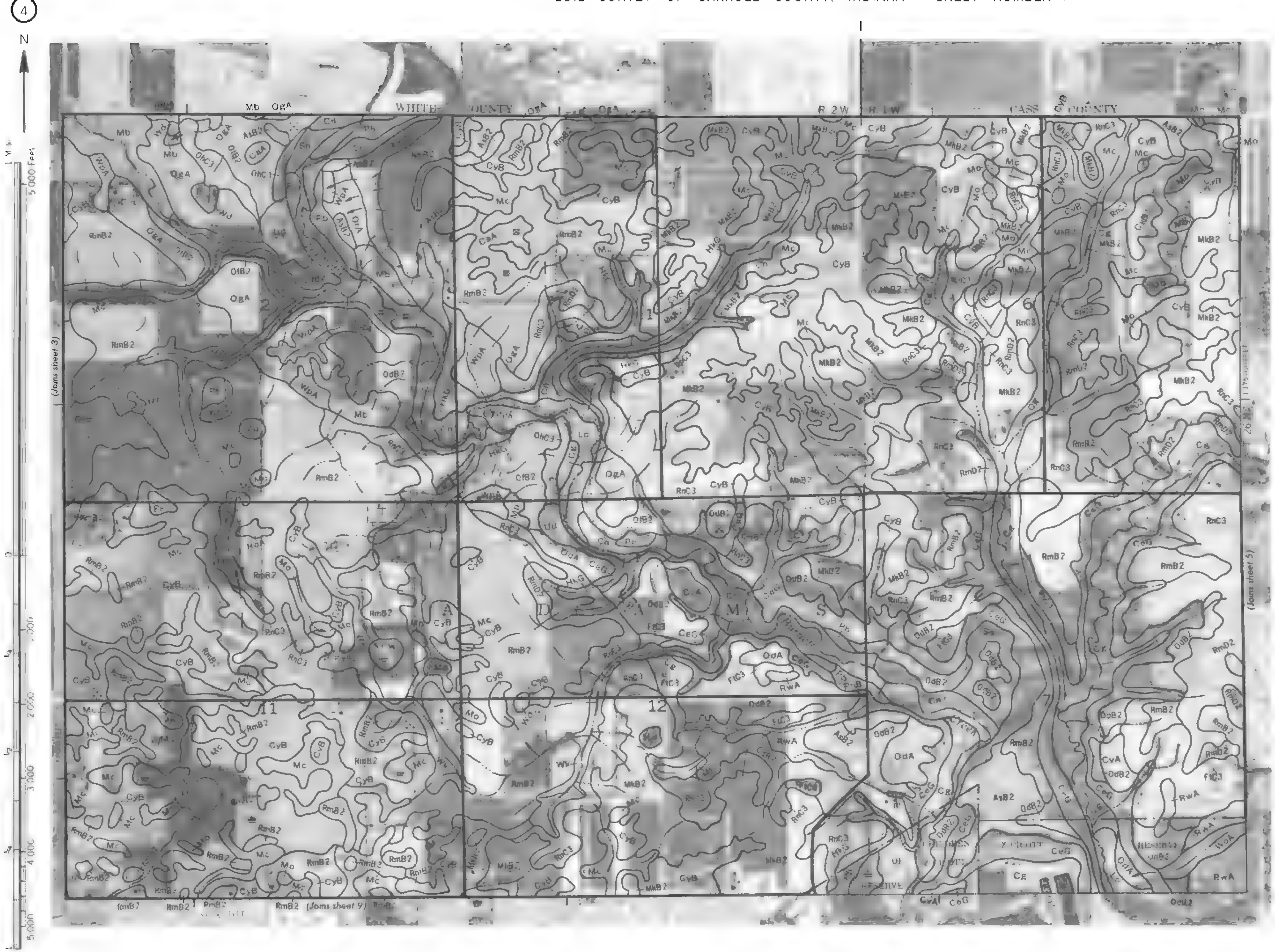
CARROLL COUNTY, INDIANA NO. 3



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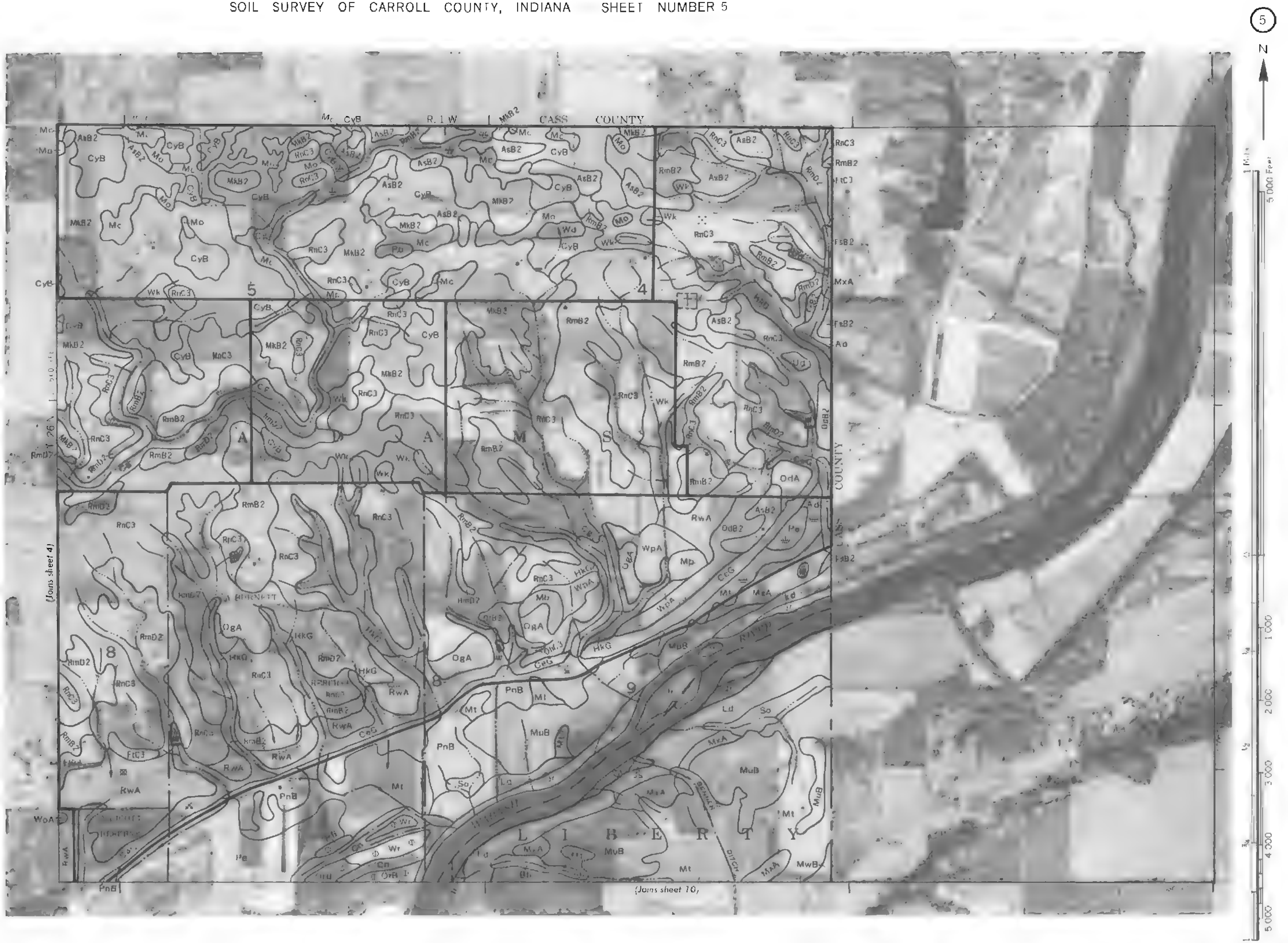

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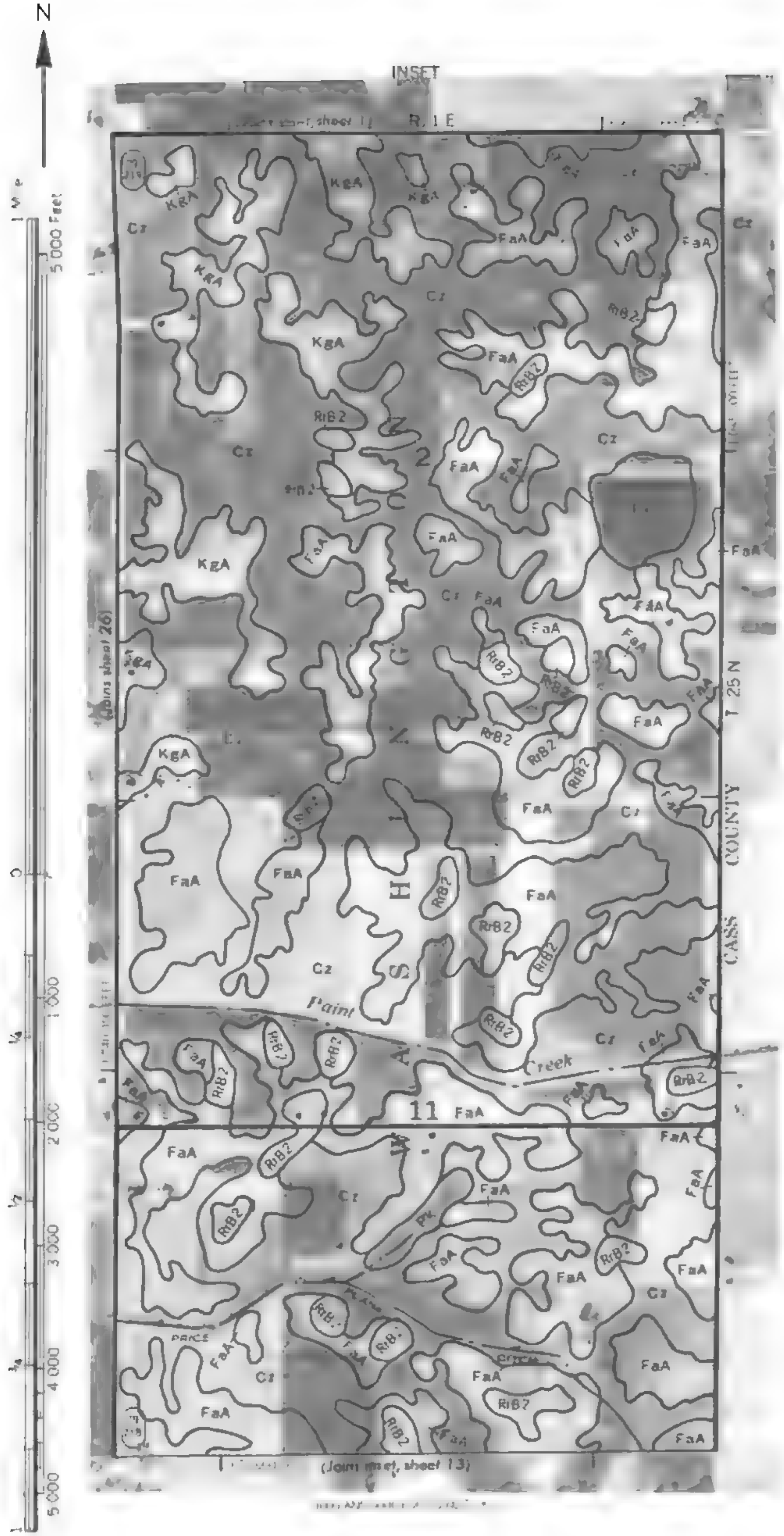
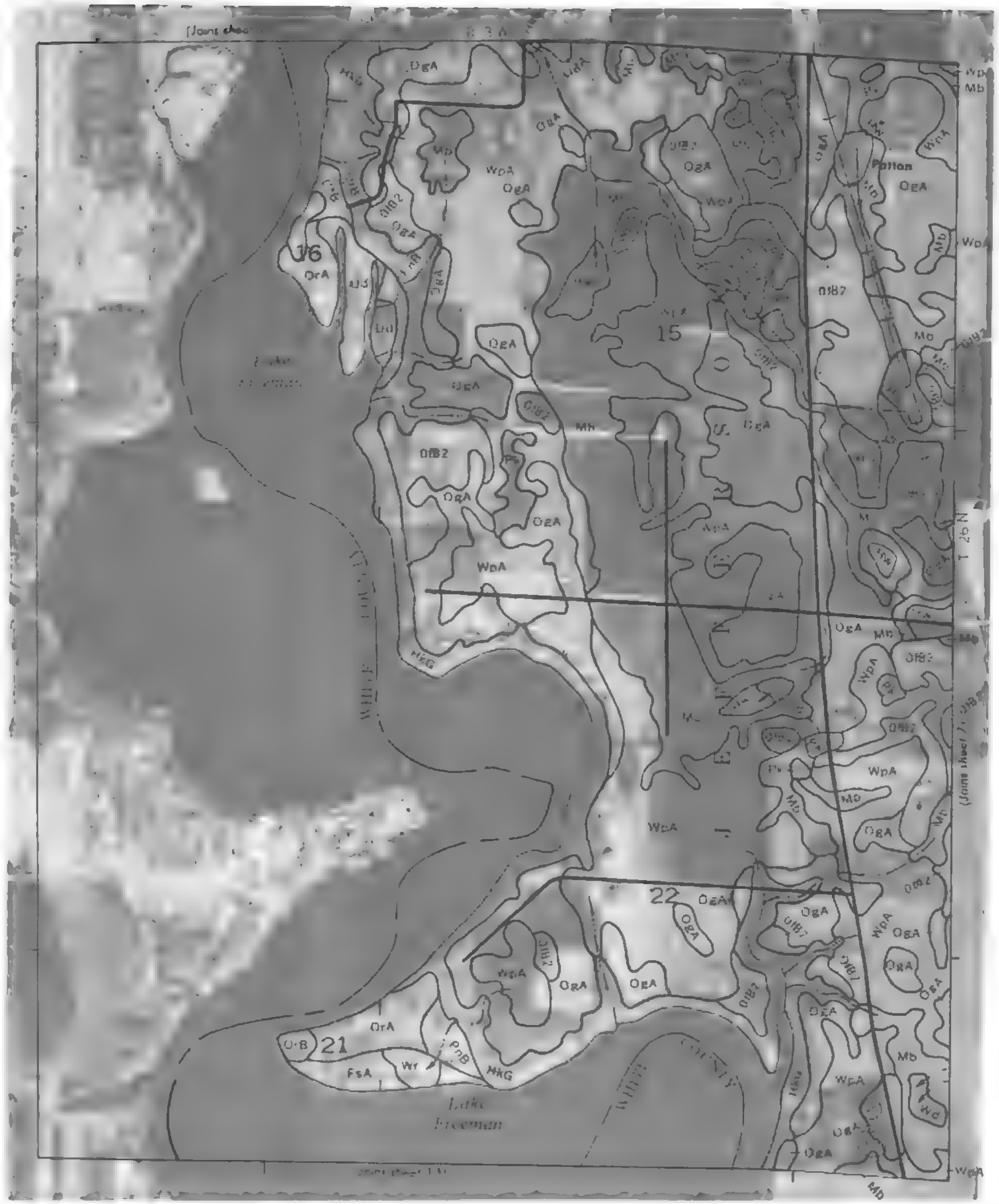
CARROLL COUNTY, INDIANA NO. 5

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 6





CARROLL COUNTY, INDIANA NO. 6

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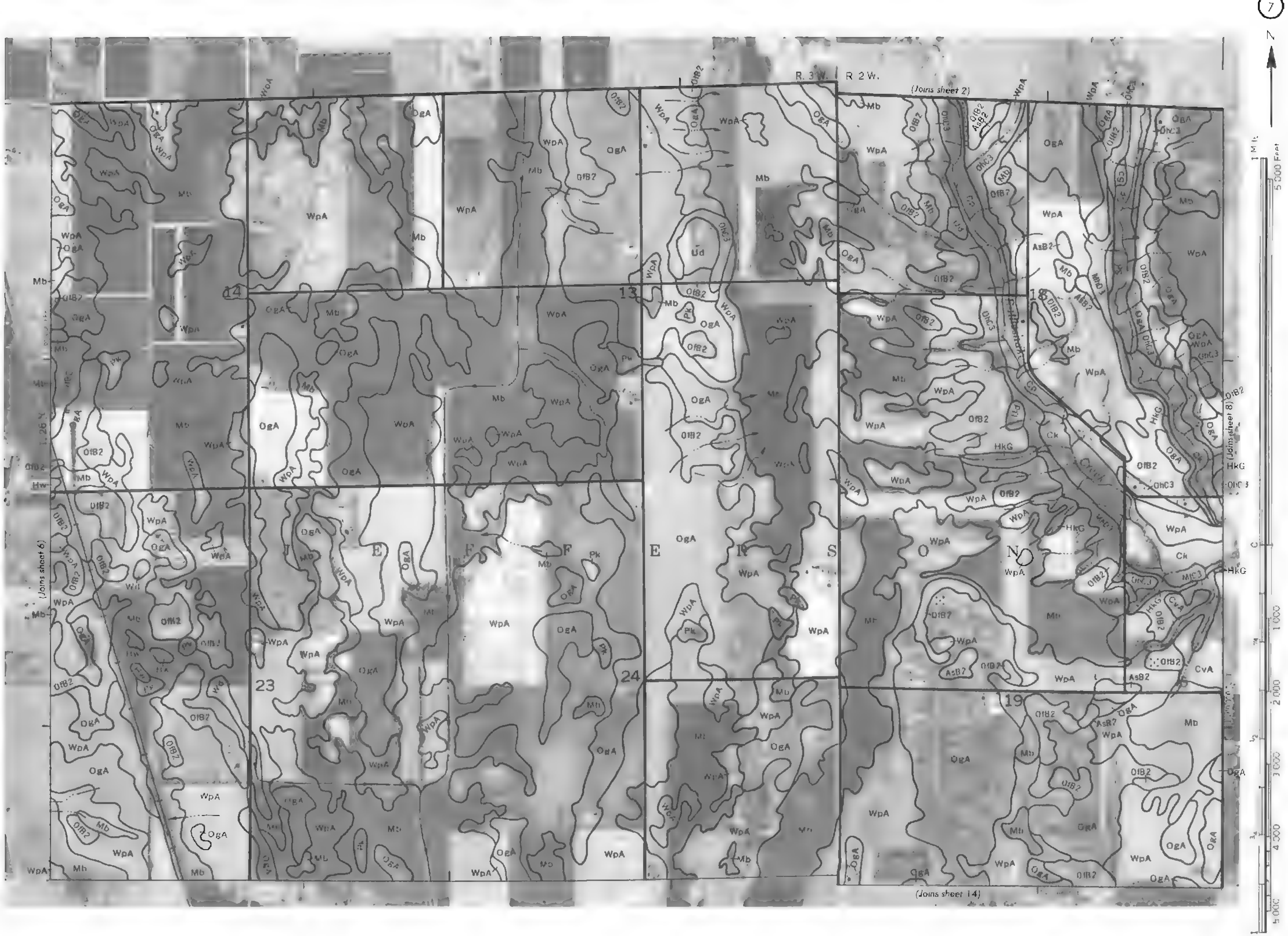

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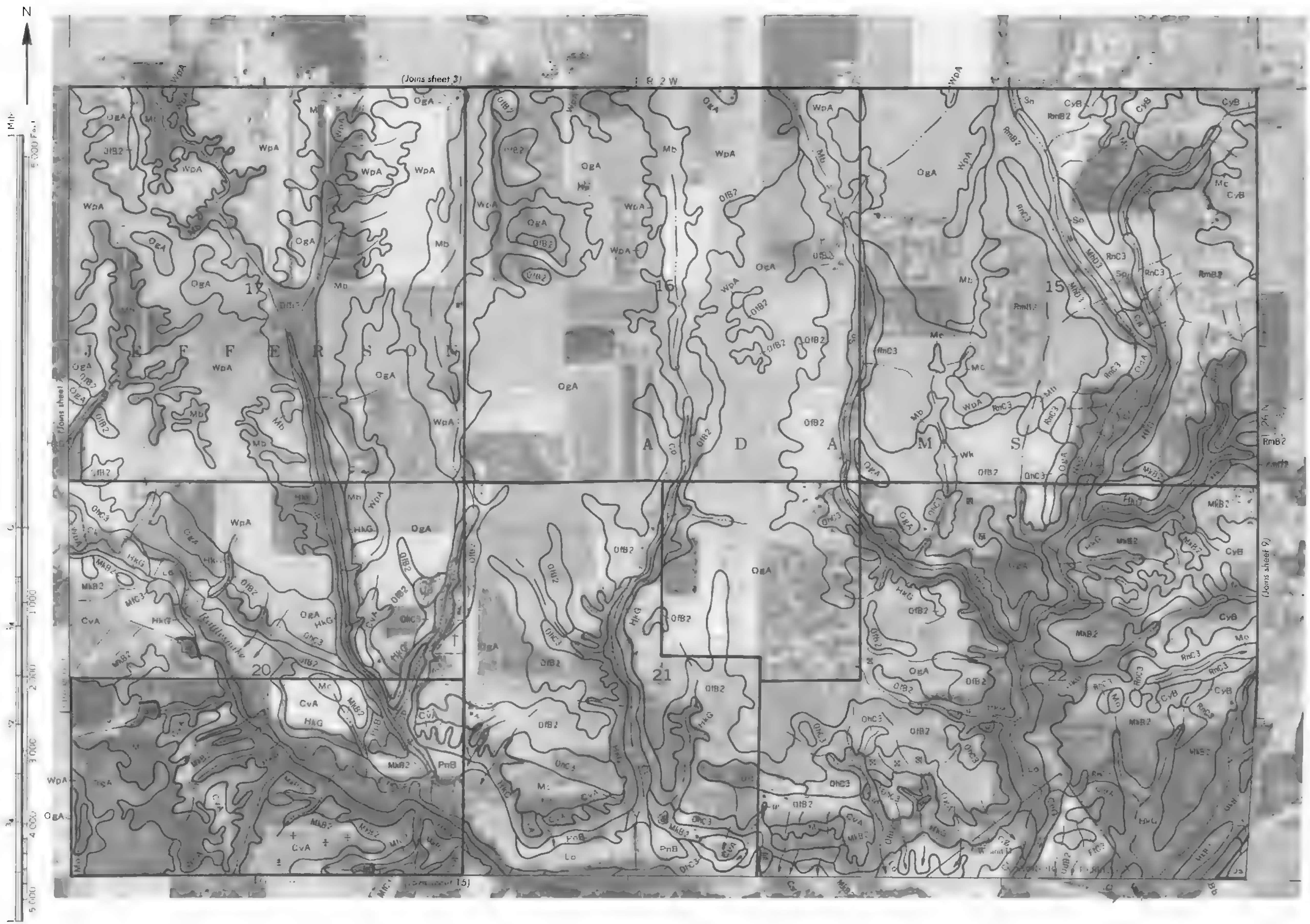
CARROLL COUNTY, INDIANA NO. 7

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 8



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CARROLL COUNTY, INDIANA NO. 9

CARROLL COUNTY, INDIANA NO. 10

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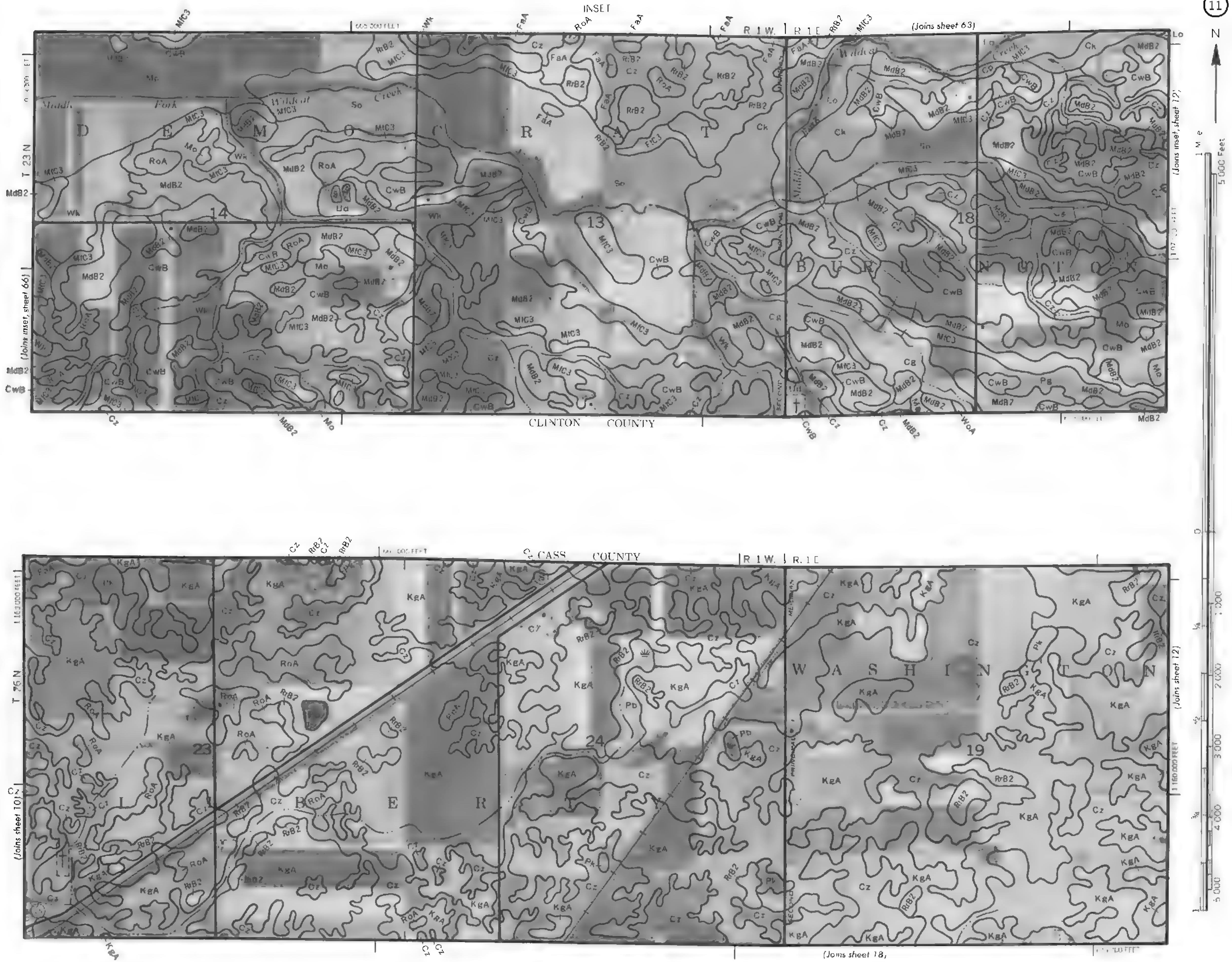

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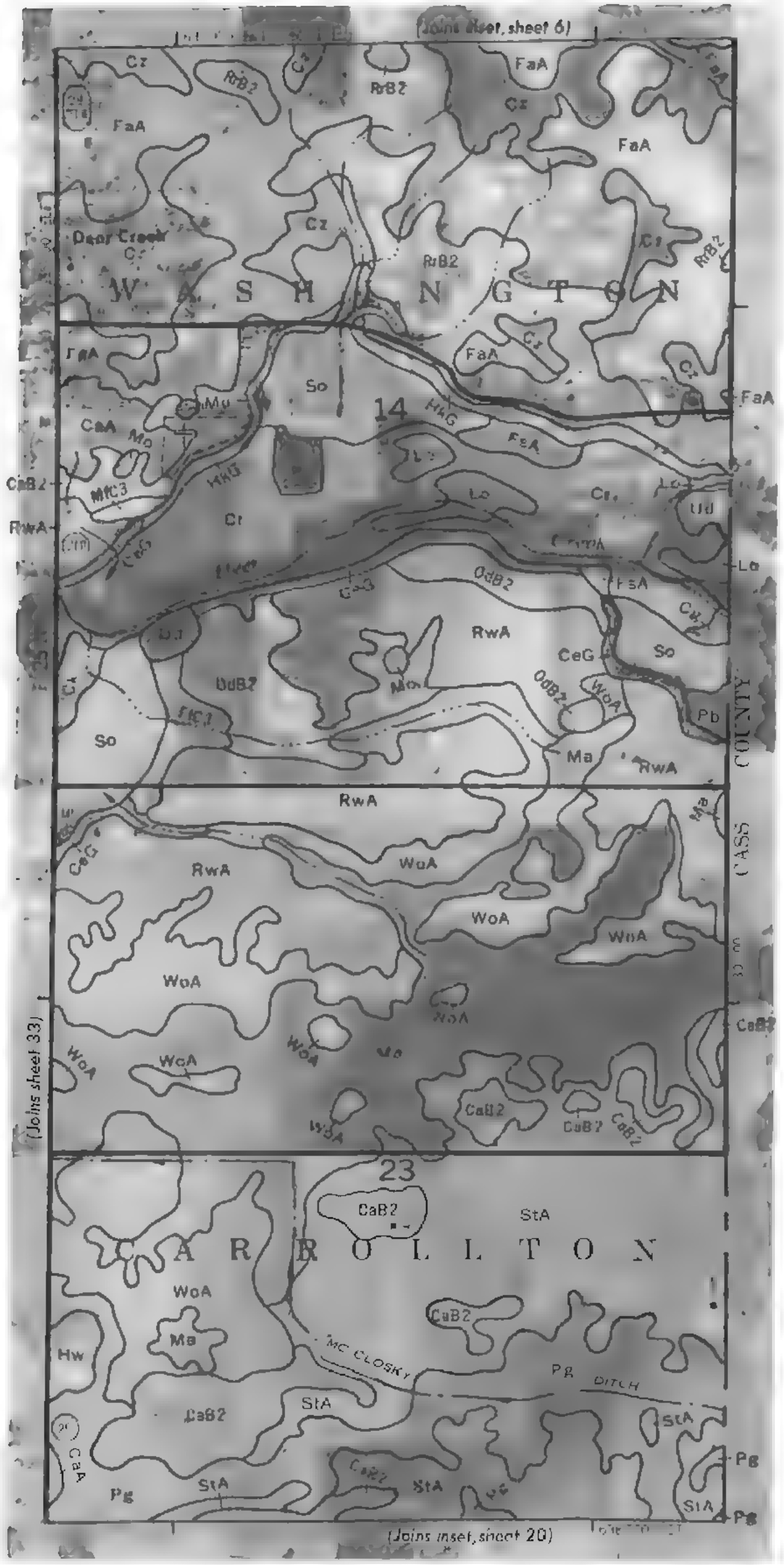
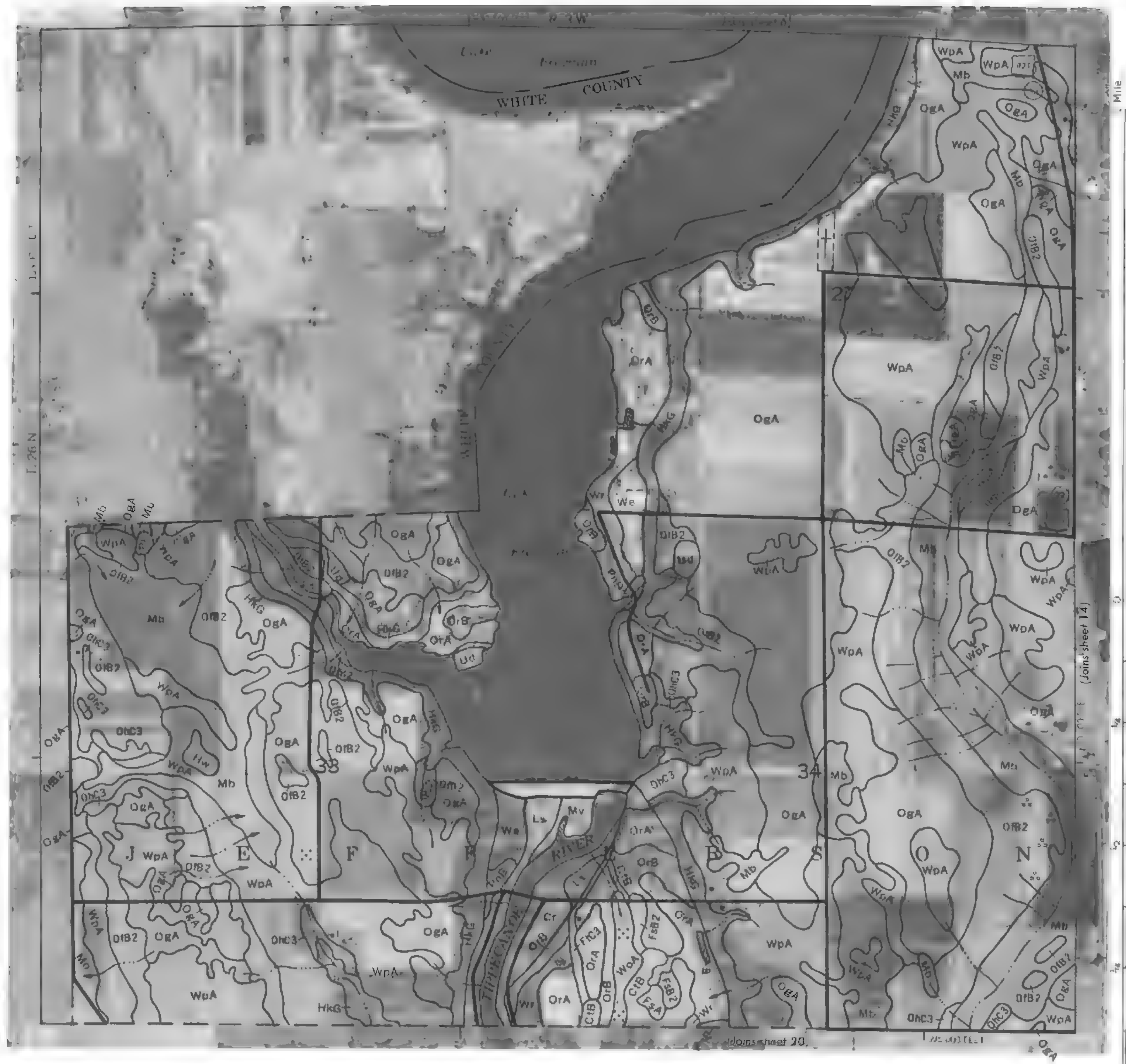
CARROLL COUNTY, INDIANA NO. 11

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 12

CARROLL COUNTY, INDIANA NO. 12

INSET



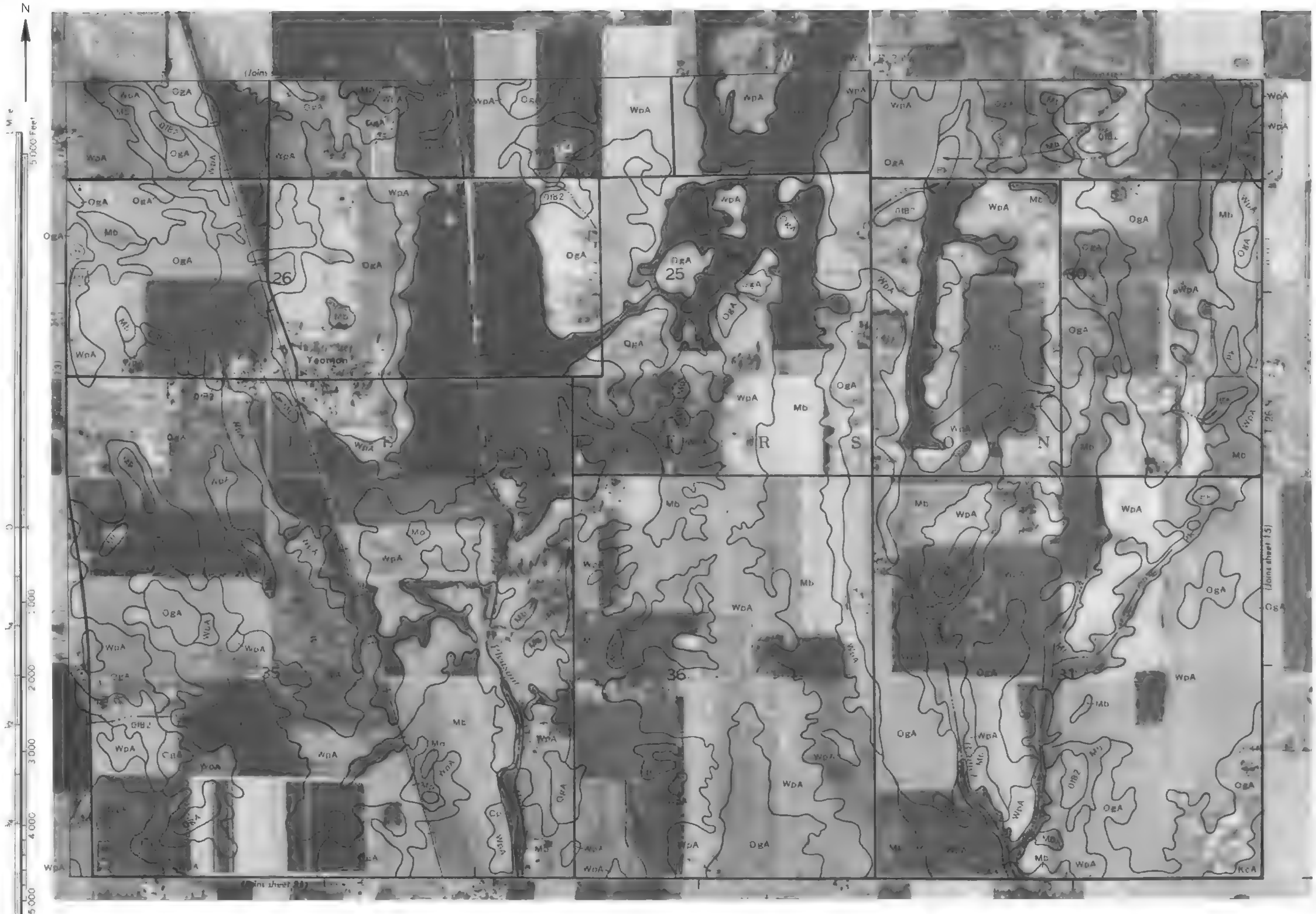


N

1 Mile

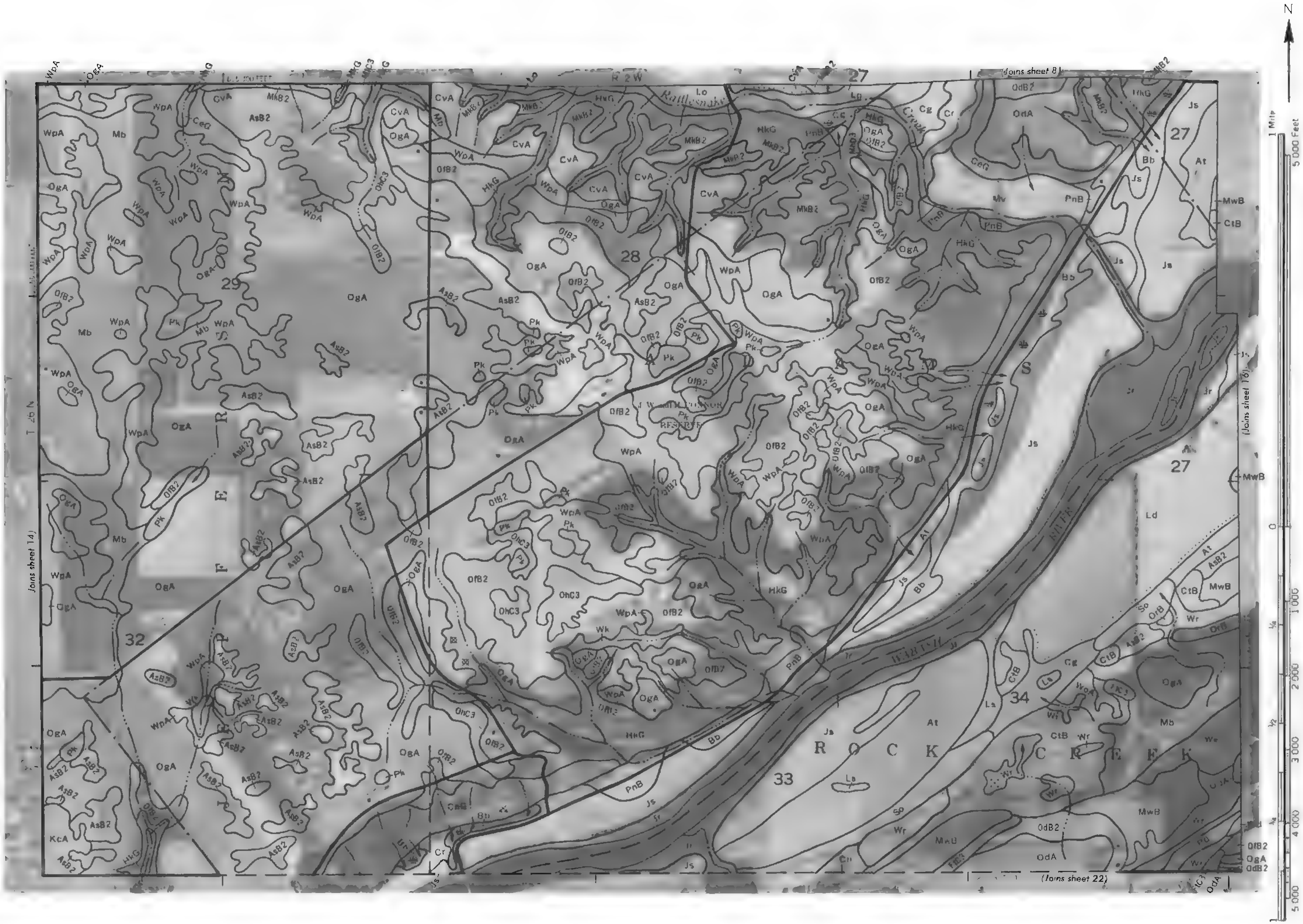
5 000 Feet

14



CARROLL COUNTY, INDIANA NO. 14

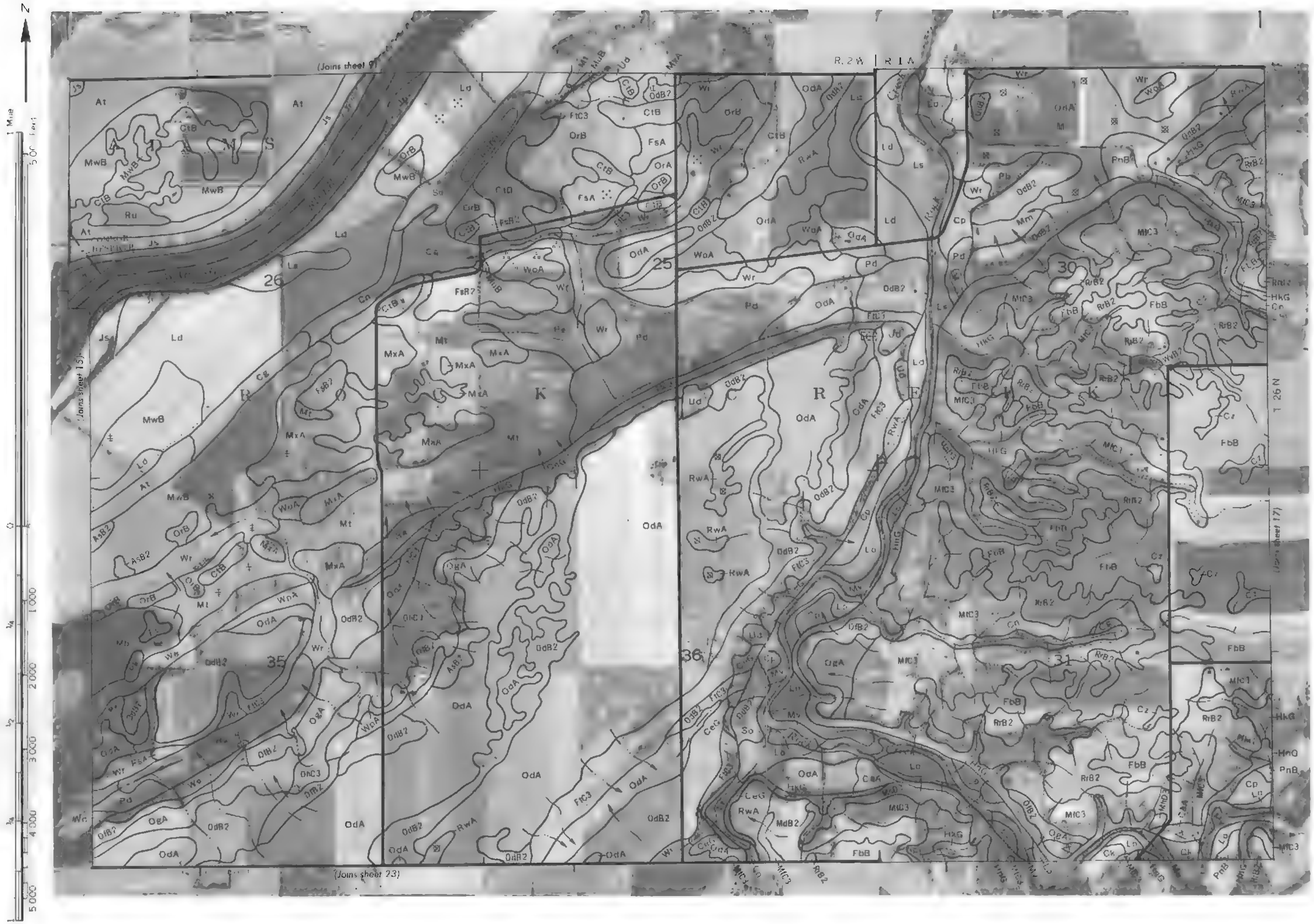
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



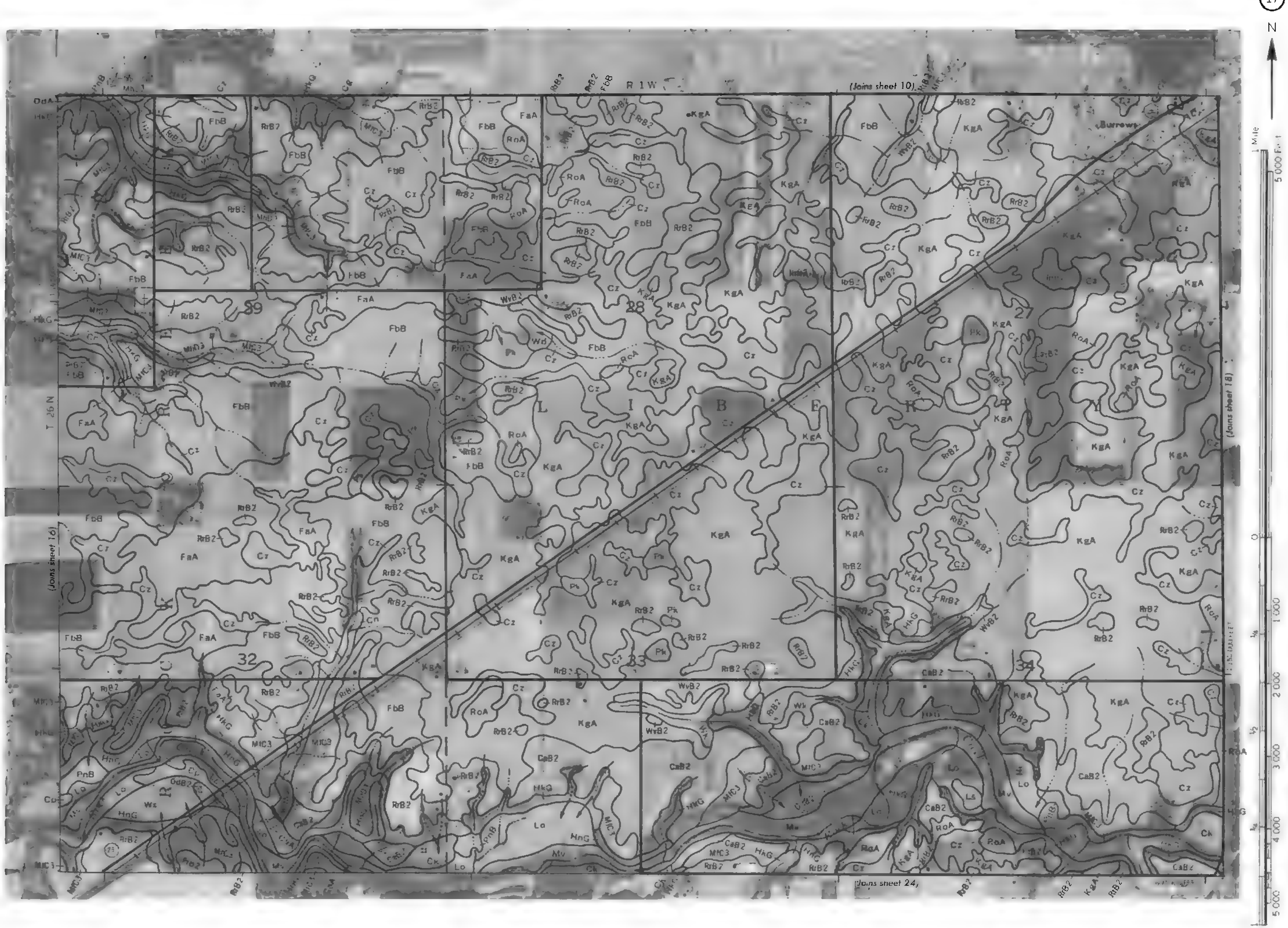
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 15

SOIL SURVEY OF CARROLL COUNTY, INDIANA - SHEET NUMBER 16



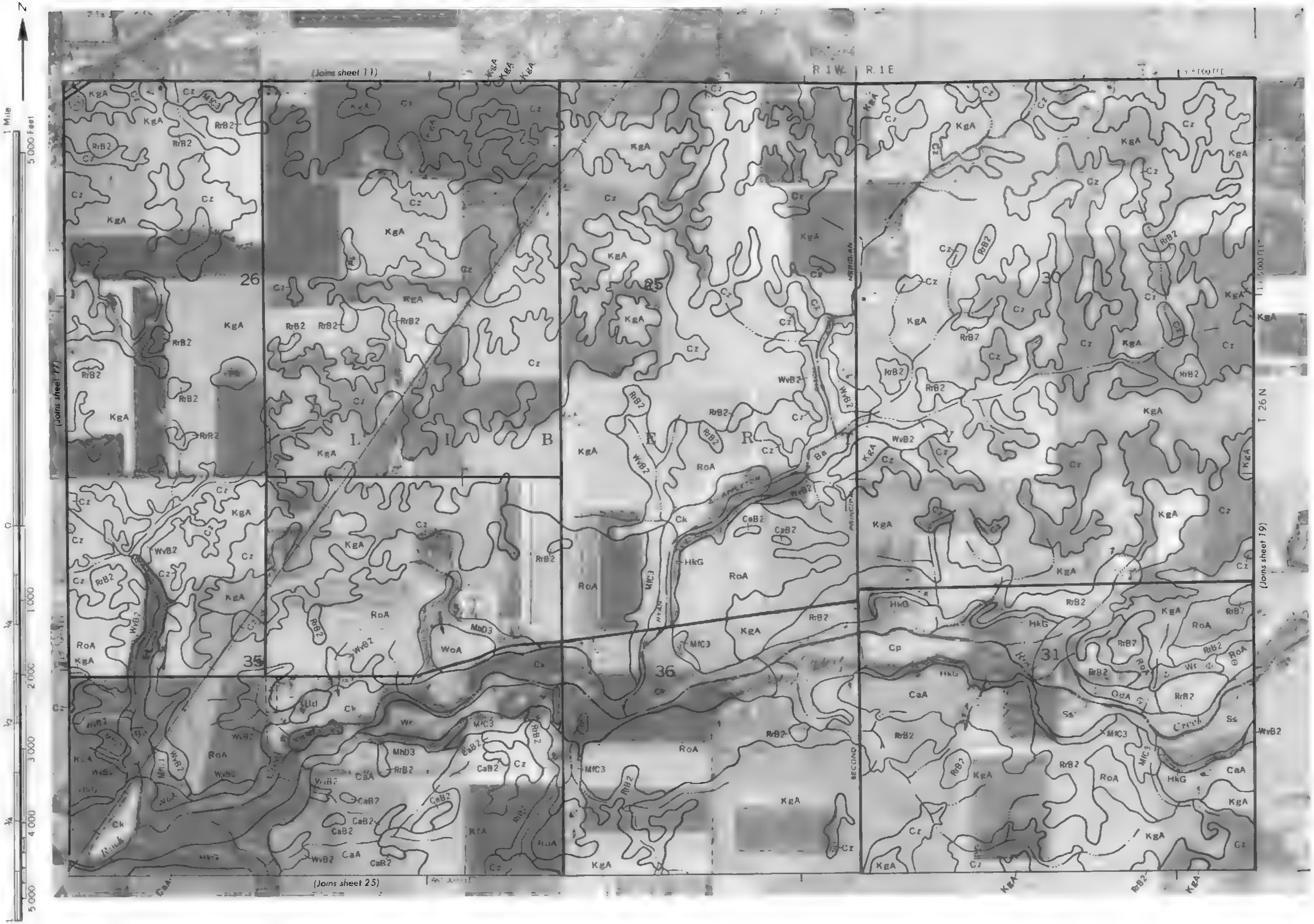
CARROLL COUNTY, INDIANA NO. 16



This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 17

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 18



CARROLL COUNTY, INDIANA NO. 18

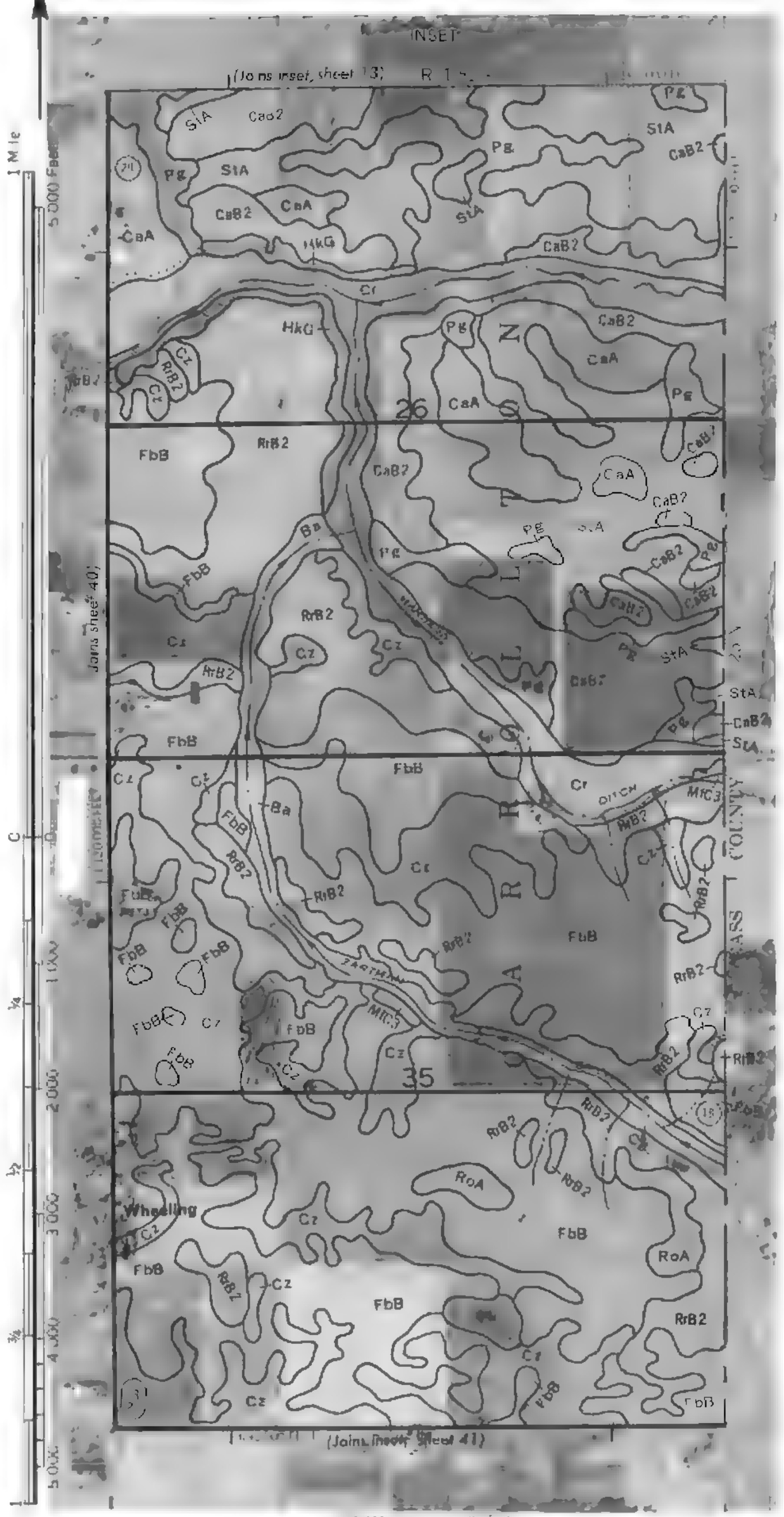
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared from 1961 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

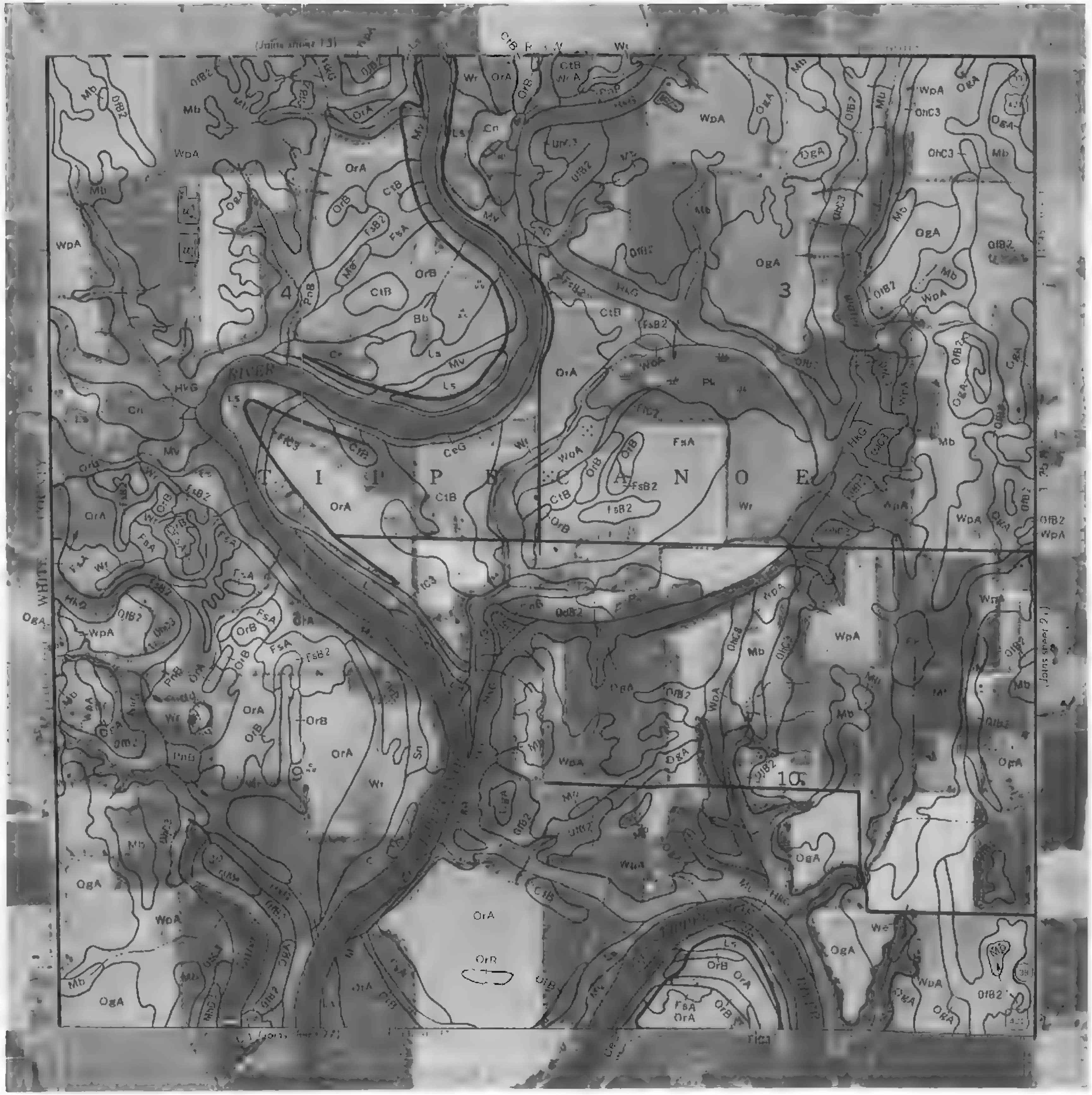
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photographs. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 19

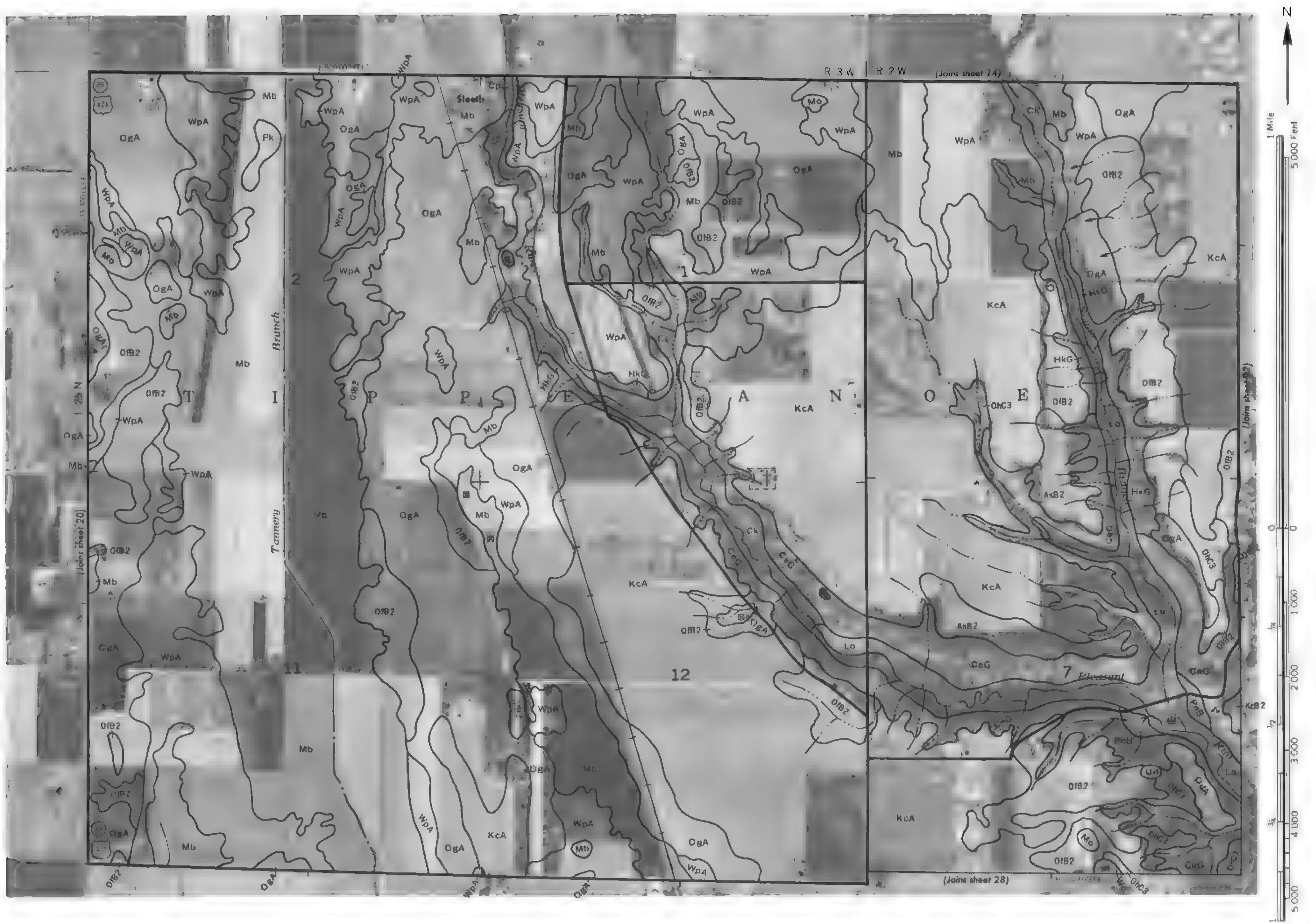
20

N



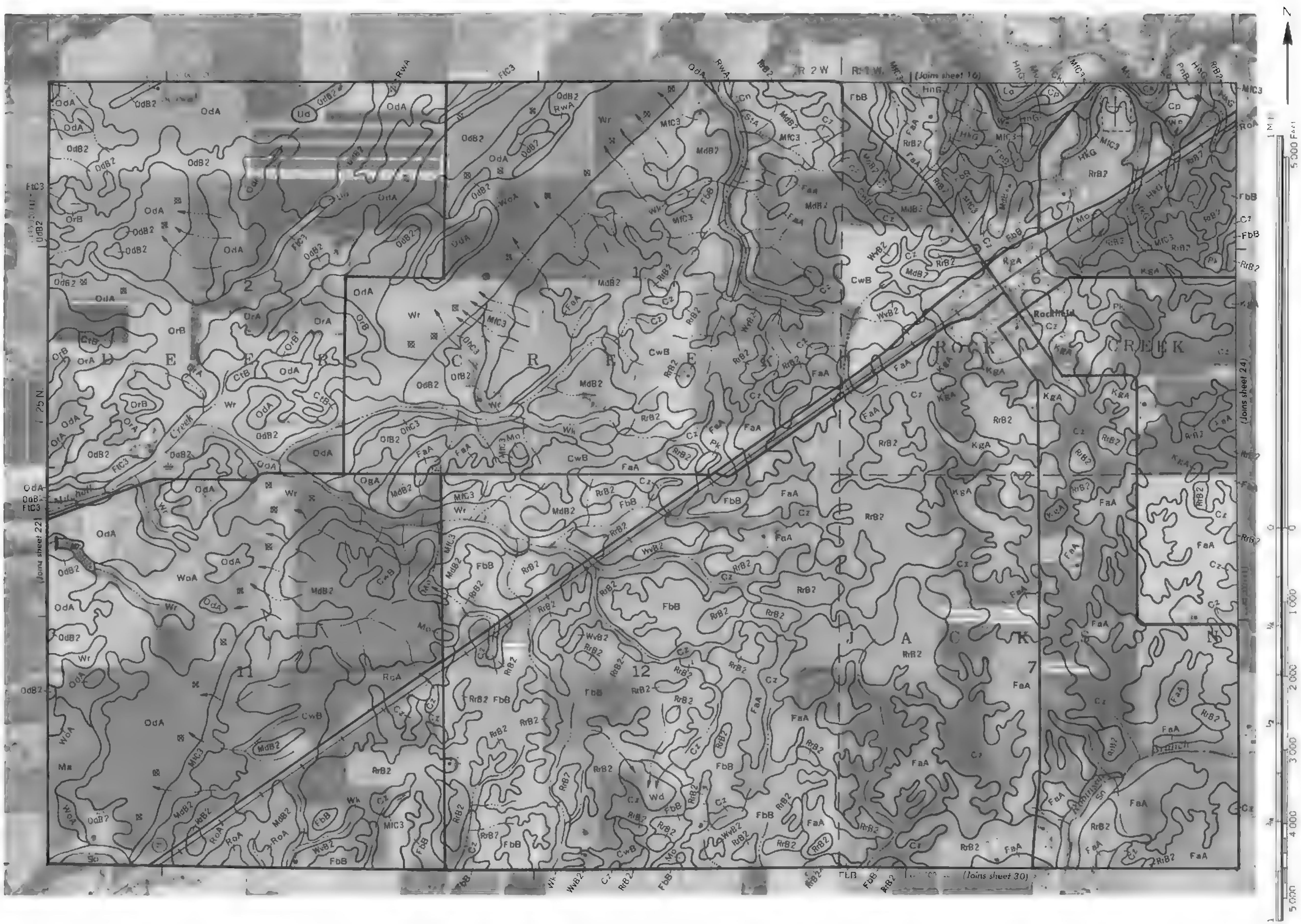


CARROLL COUNTY, INDIANA NO. 20



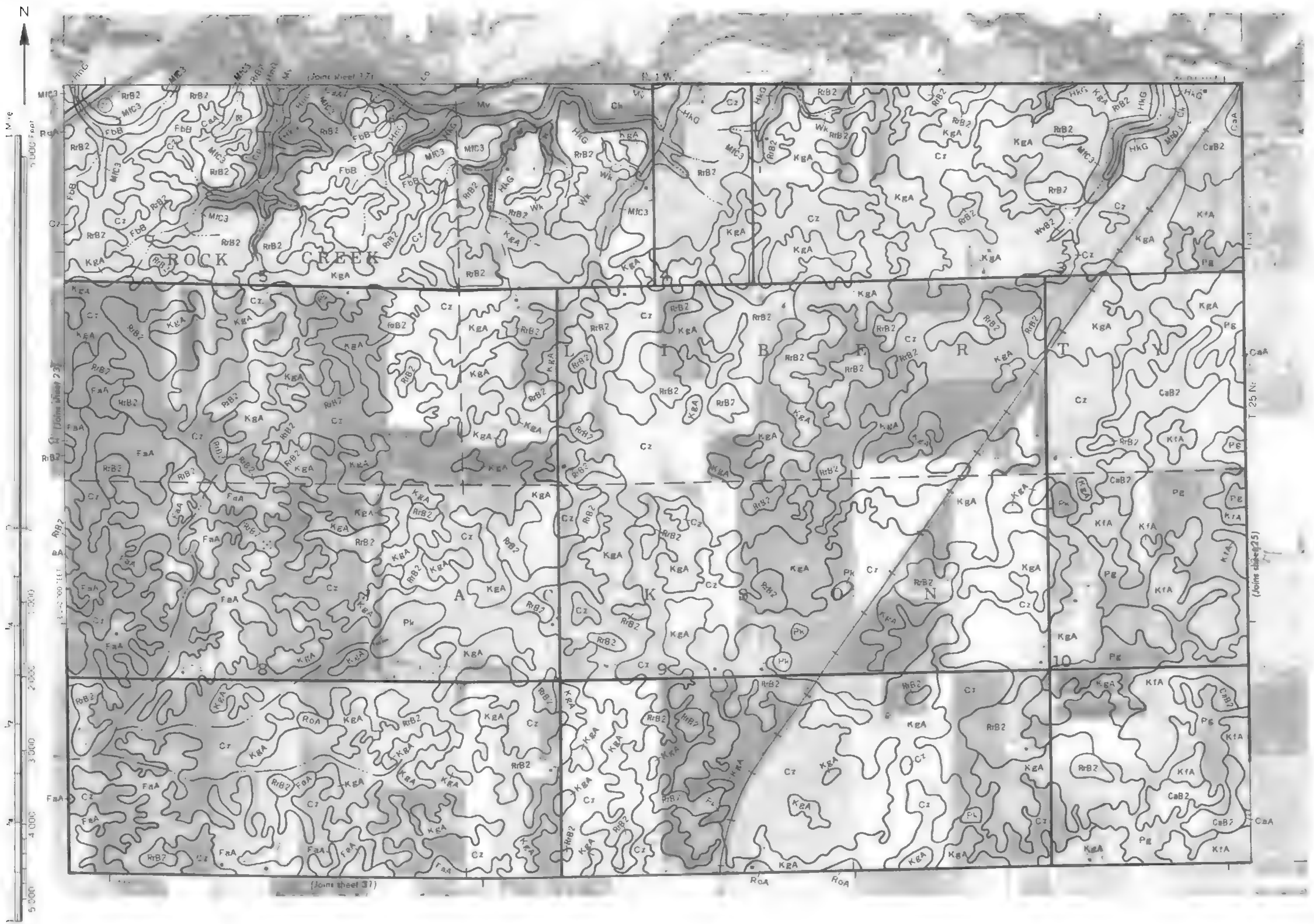
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 Mile
5 000 Feet
(Joins sheet 15)
R 2 W.
TIPPECANOE
RIVER
Mitchell
A. BONDIE
RESERVE
DEER CREEK
(Joins sheet 29)
(Joins sheet 23)
(Joins sheet 21)



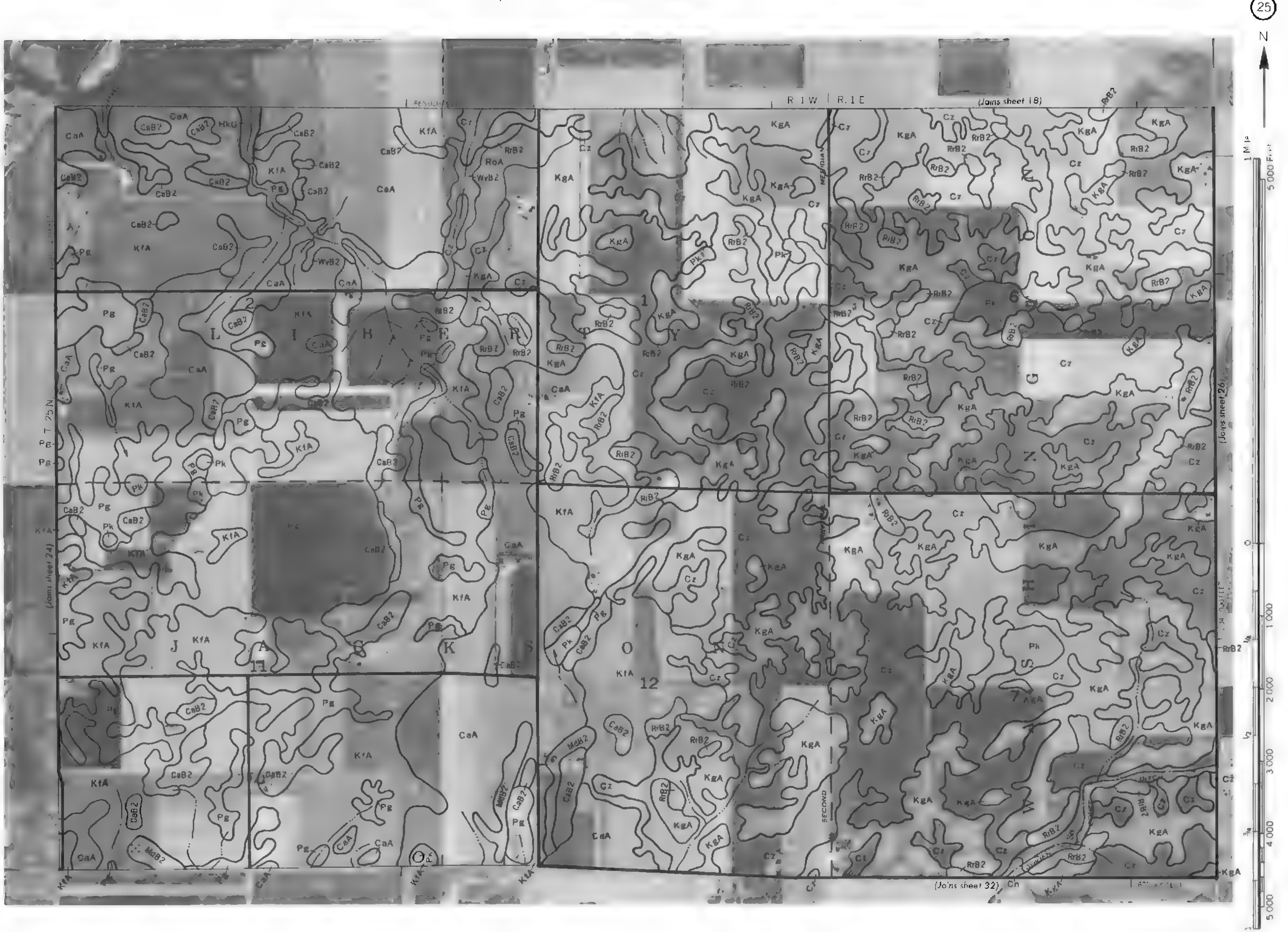
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

24



CARROLL COUNTY, INDIANA NO. 24

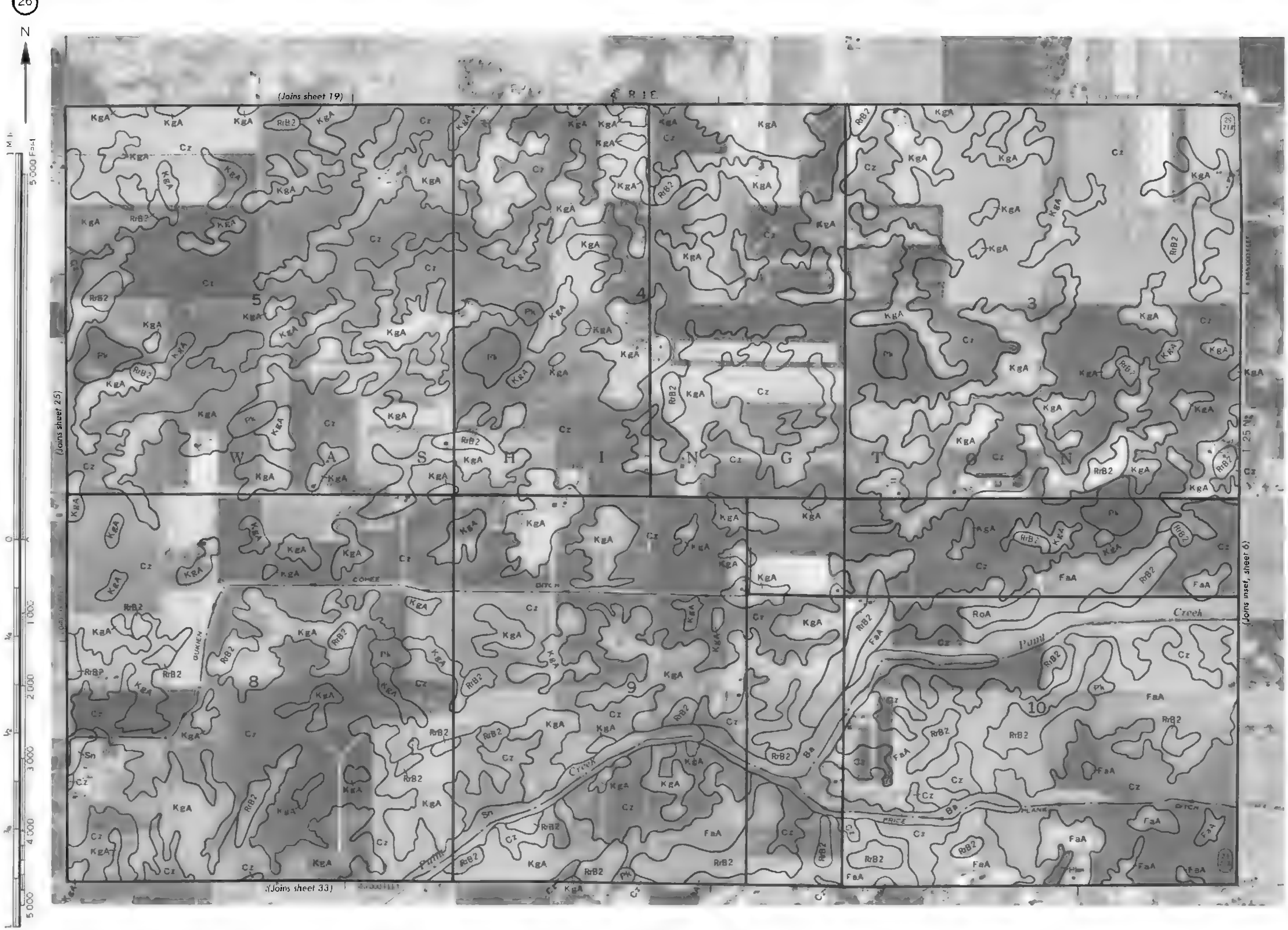
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photographs. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY INDIANA NO. 25

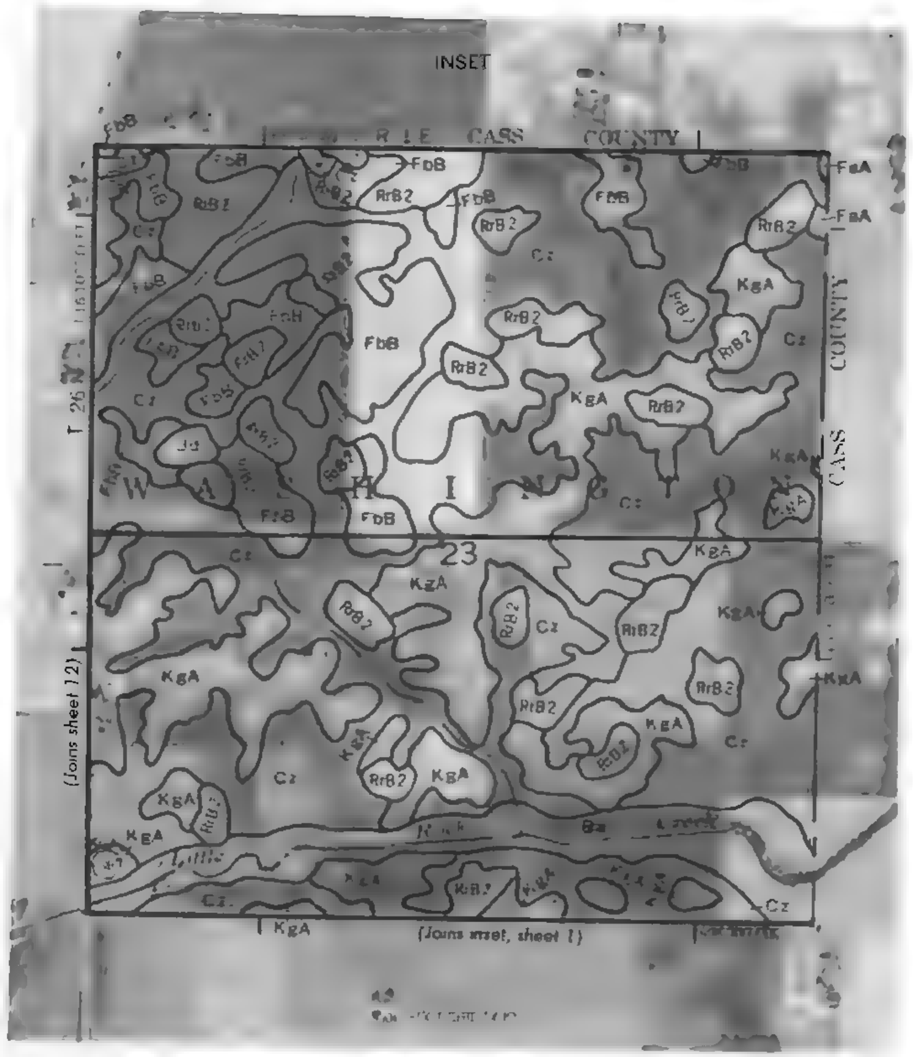
SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 26

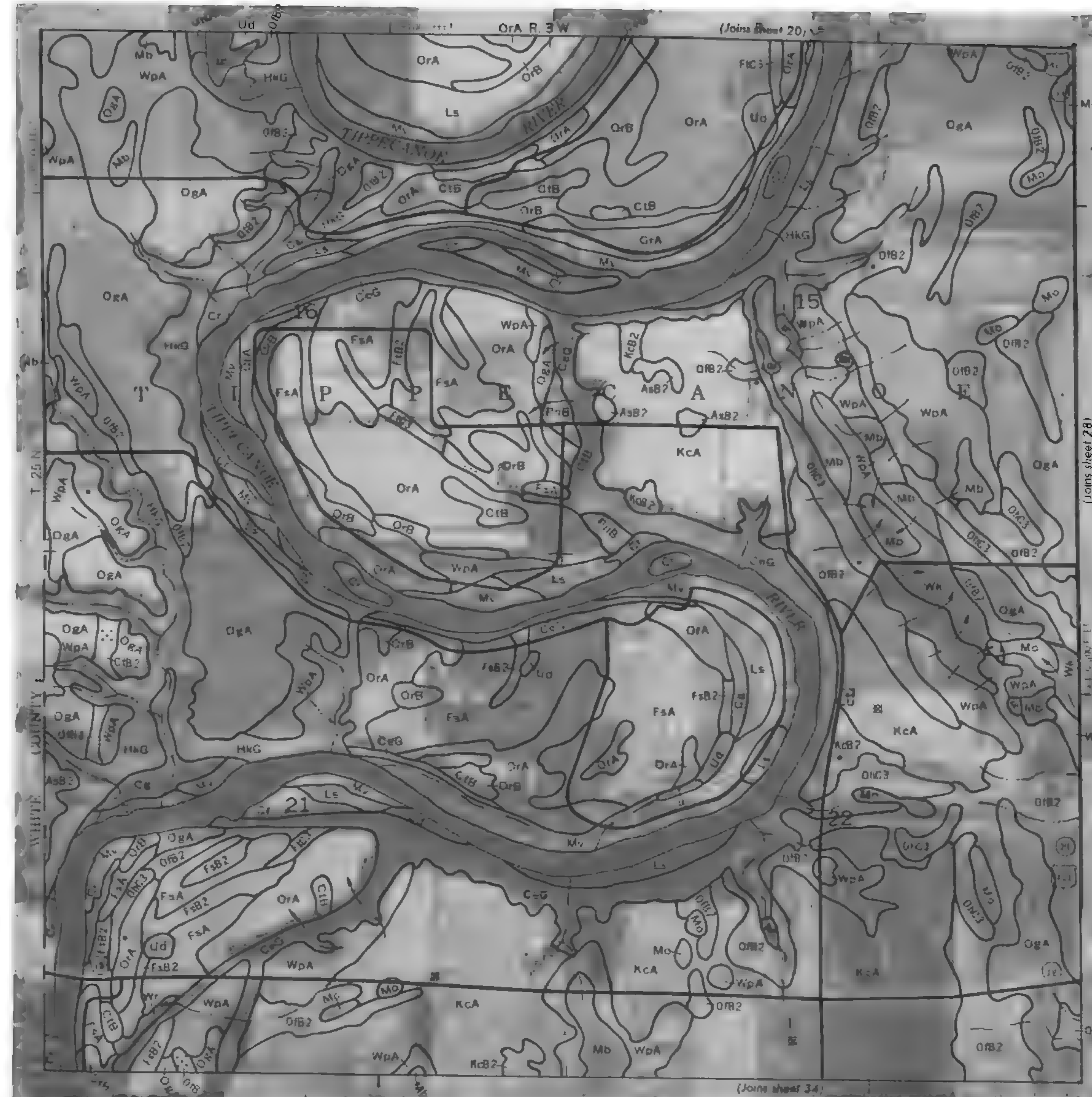


CARROLL COUNTY, INDIANA NO. 26

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1961 aerial photography. Coordinate grid ticks and land division corners, if

27





This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

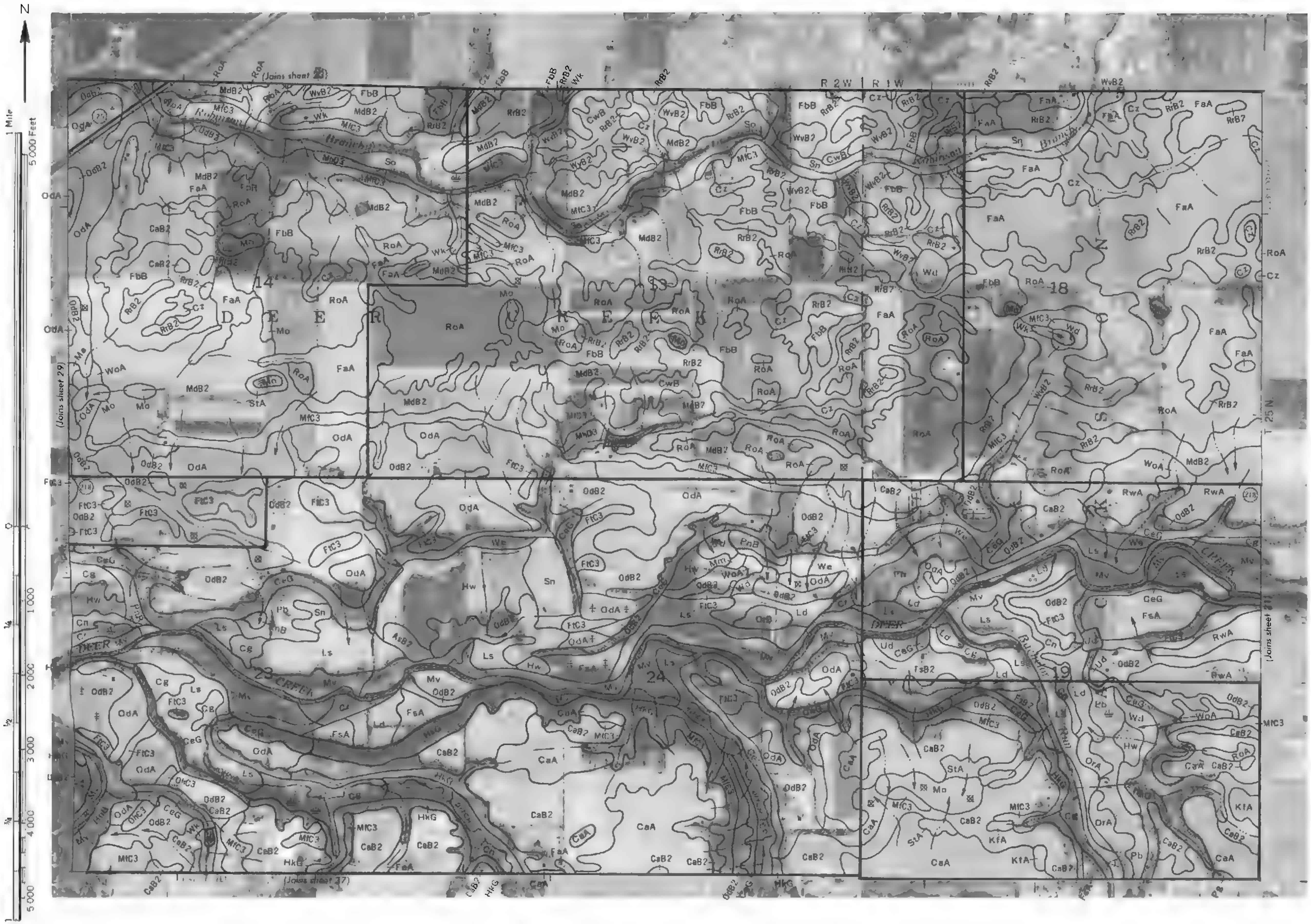

N
1 Mile
5 000 Feet
(Joins sheet 21)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 35)
R. 3 W.
R. 2 W.
TIPPECANOE
DEER CREEK
WABASH
RIVER
Tunnery
DELPHI
(county seat)
Pittsburg
water
13
14
18
19
23
24

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 29

30

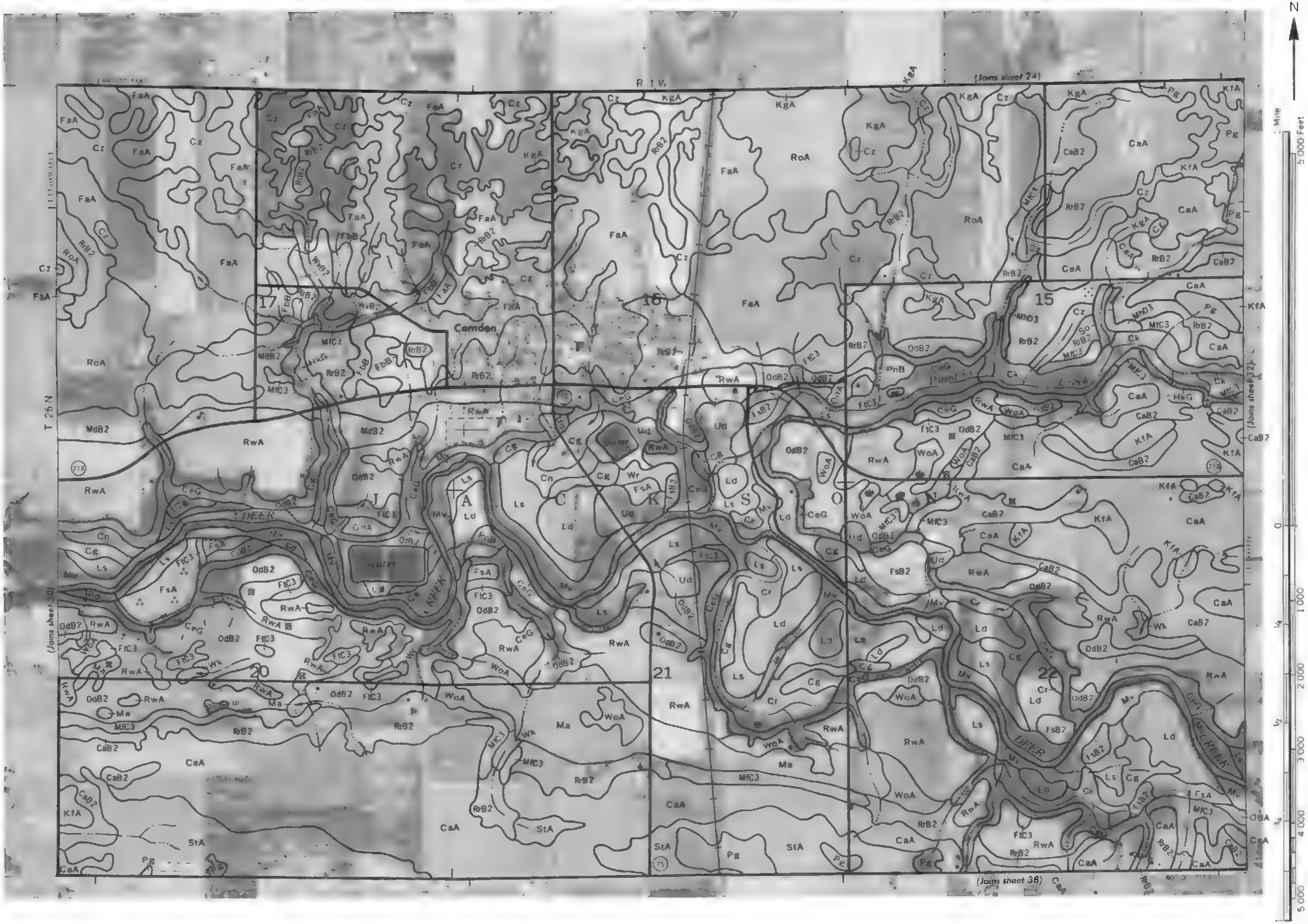
SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 30



CARROLL COUNTY, INDIANA NO. 30

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

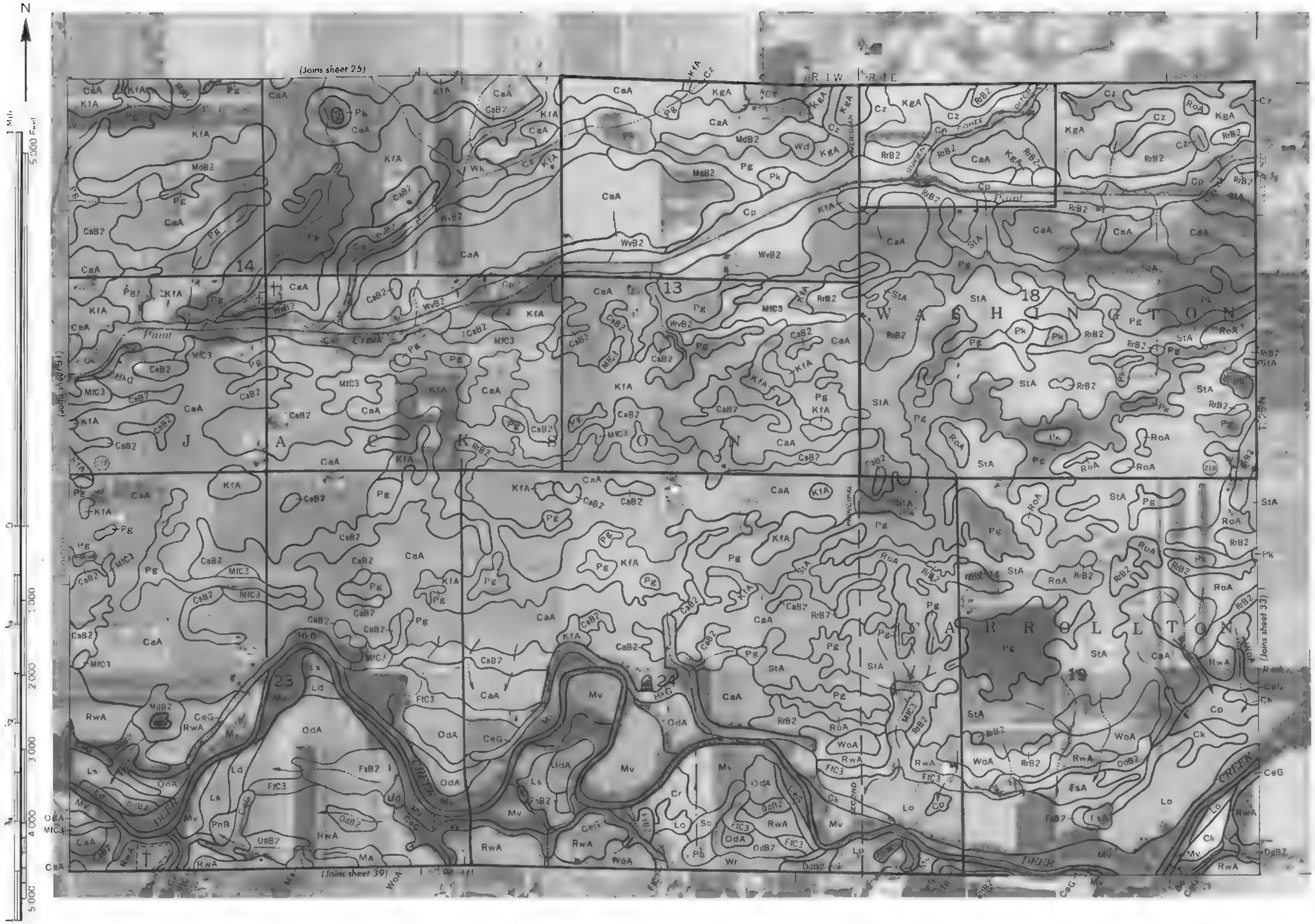
(31)



This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 31

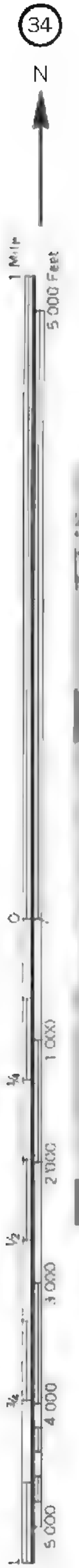
SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 32

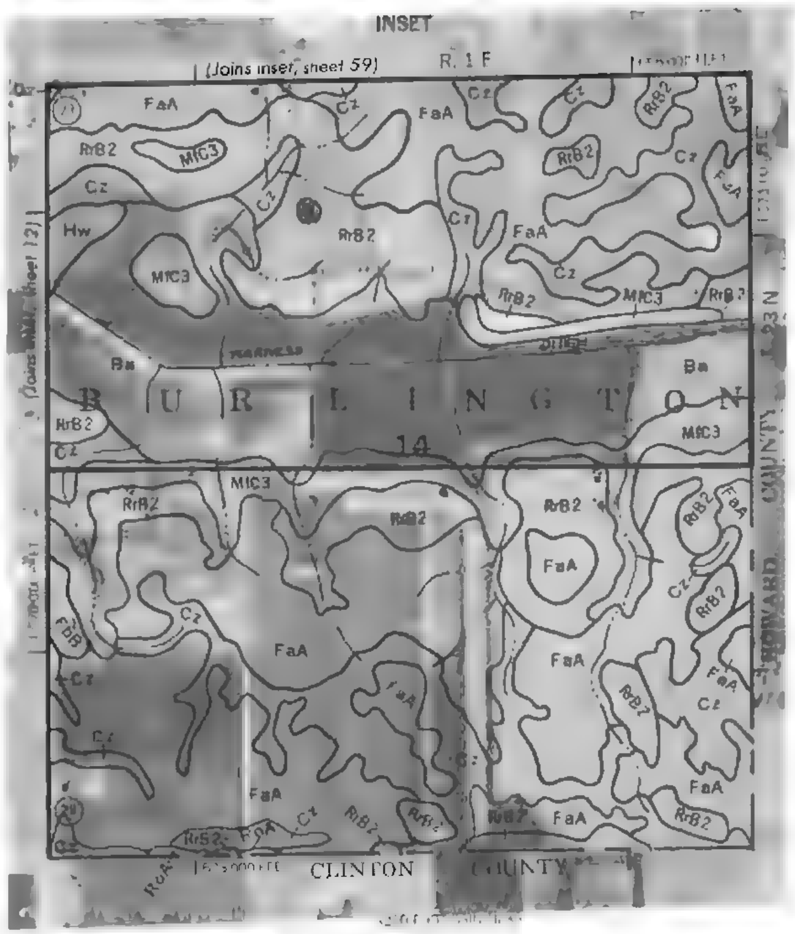


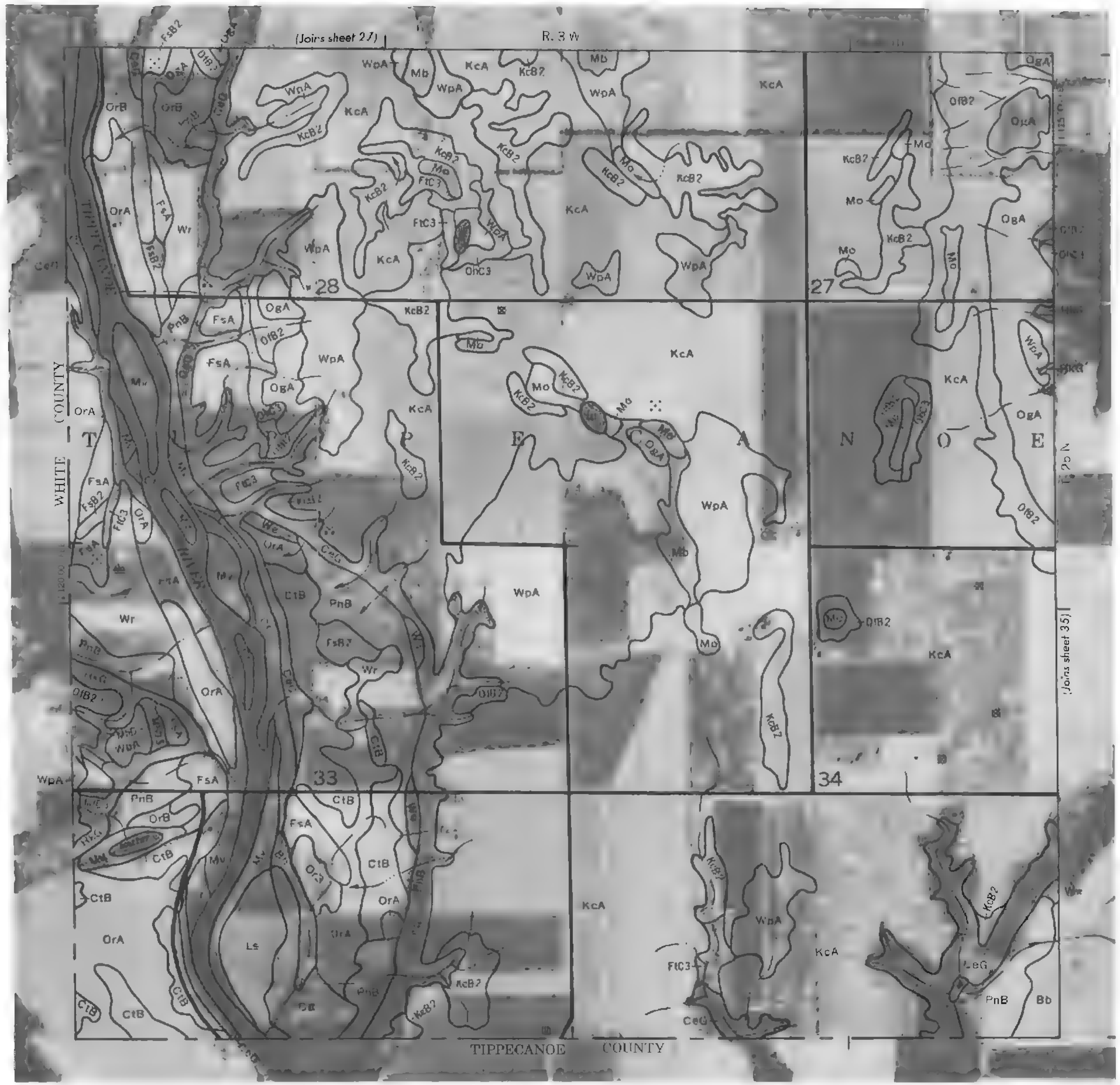
CARROLL COUNTY, INDIANA NO. 32

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photographs. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 33


34
N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000


INSET
(Joins inset, sheet 59)
R. 1 E.
B U R L I N G T O N
14
CLINTON COUNTY
HOWARD COUNTY
T. 23 N.
FaA
RrB2
MlC3
Cz
Hw
Ba
FaA


(Joins sheet 27)
R. 3 W.
28
27
33
34
T E P P E C A N O E
WHITE COUNTY
TIPPECANOE RIVER
TIPPECANOE COUNTY
(Joins sheet 35)
T. 25 N.
KcA
WpA
KcB2
OgA
OfB2
Mo
OrA
CtB
PnB
FsA
Wr

35

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 35

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 36

37

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 37

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 38

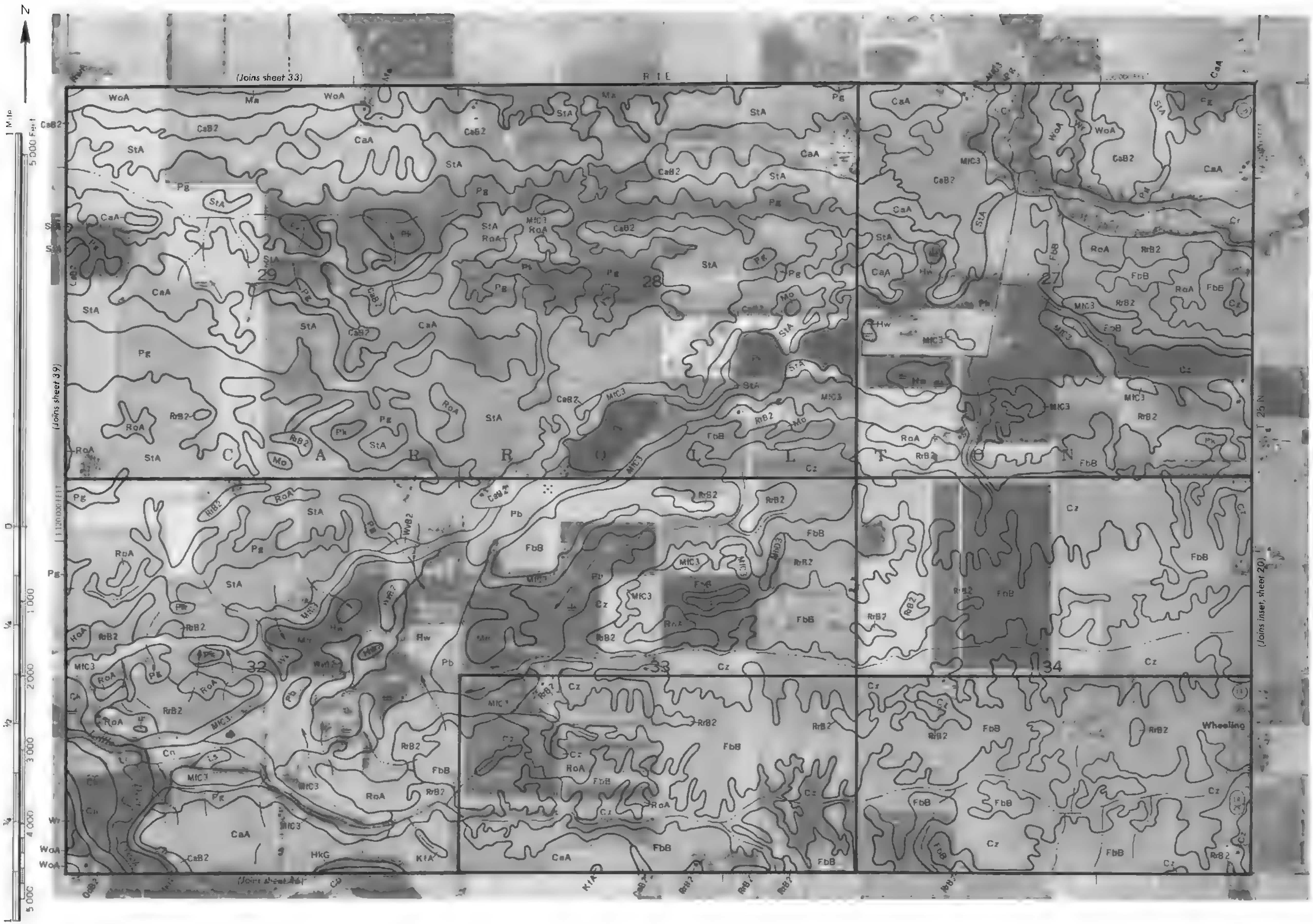
CARROLL COUNTY, INDIANA NO. 38

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1971 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from [illegible] aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 39

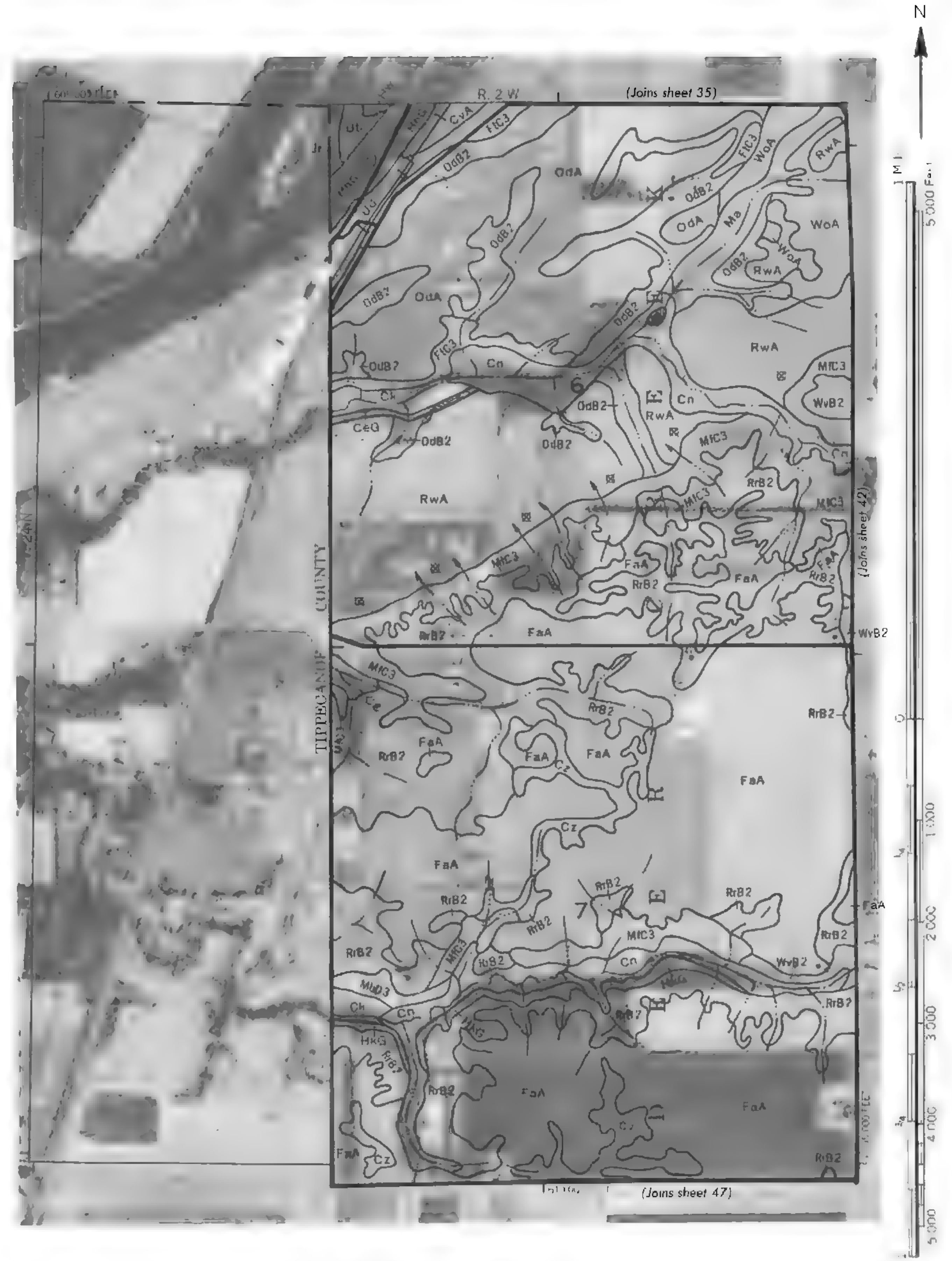
SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 40



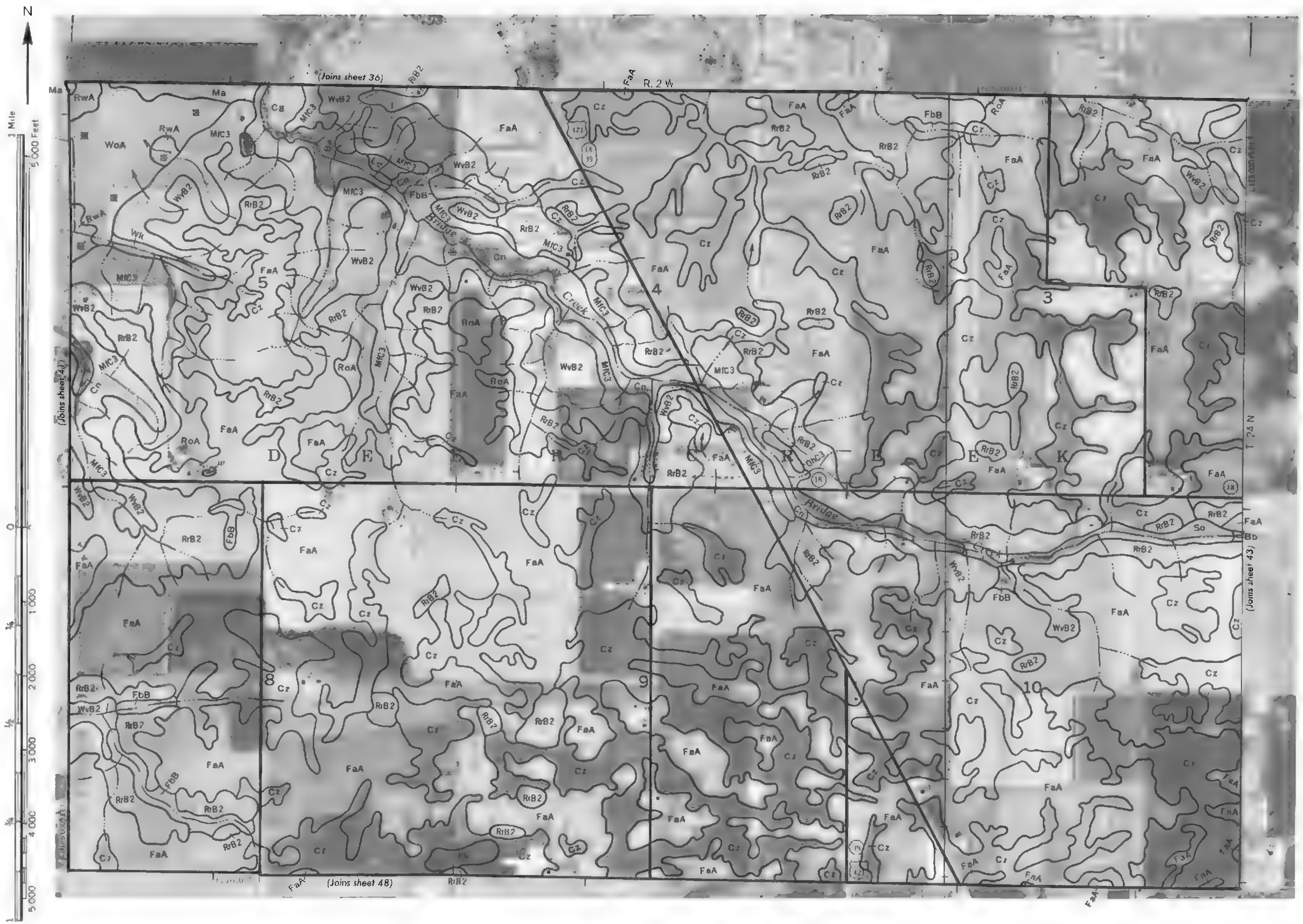
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photographs. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 41

INSET



SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 42



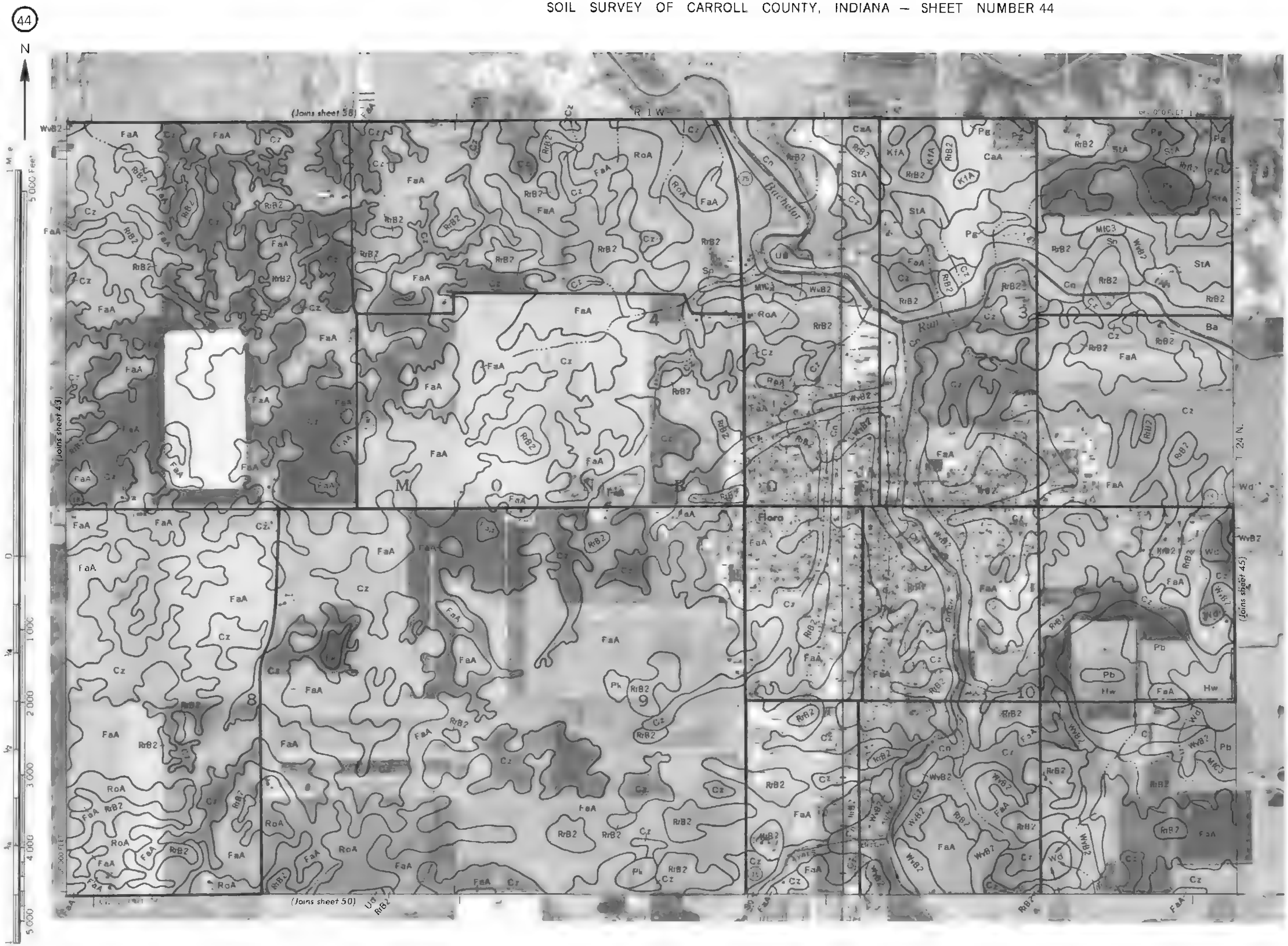
CARROLL COUNTY, INDIANA NO. 42

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photographs. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

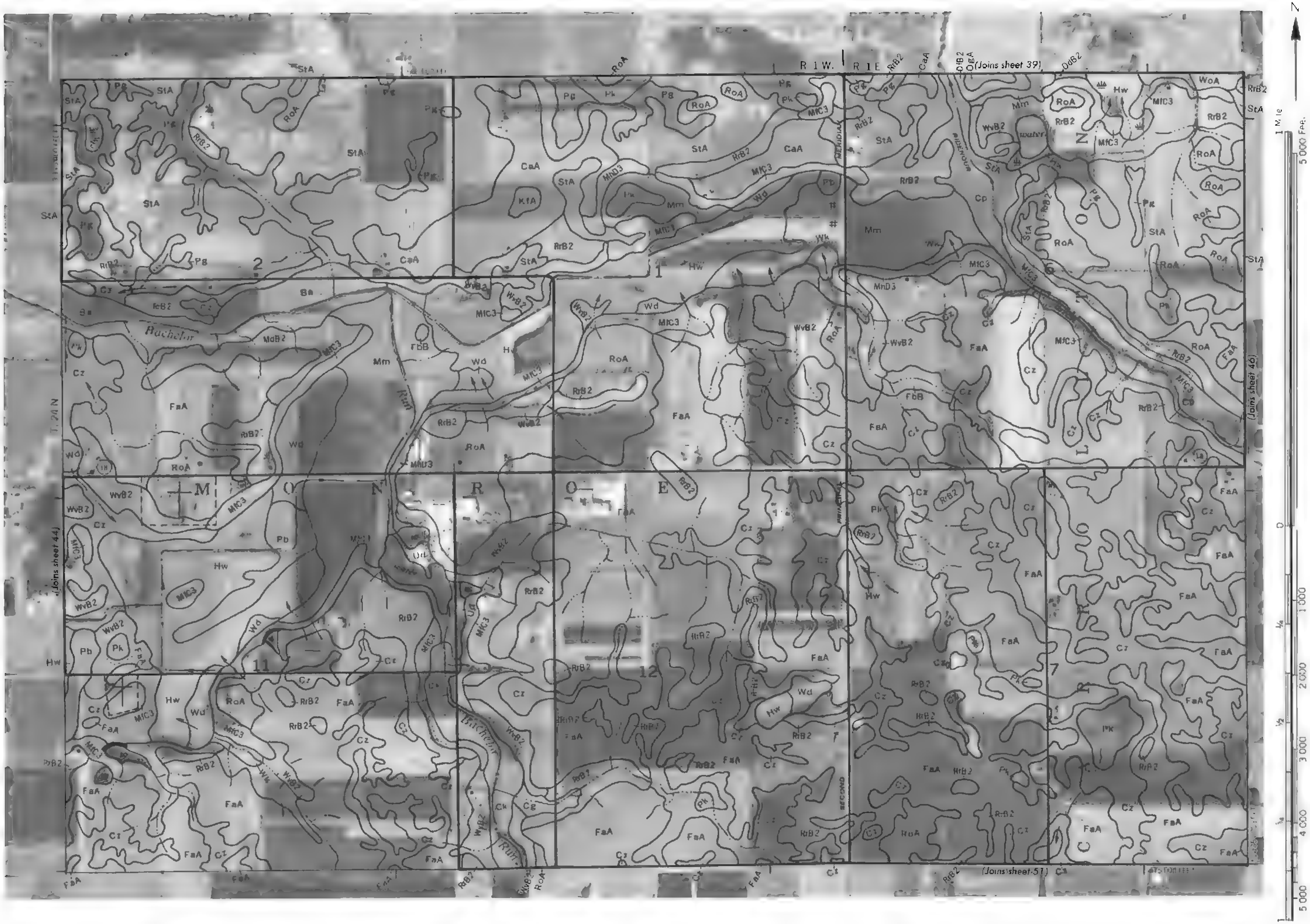
CARROLL COUNTY, INDIANA NO. 43

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 44



CARROLL COUNTY, INDIANA NO. 44

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 45

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 46

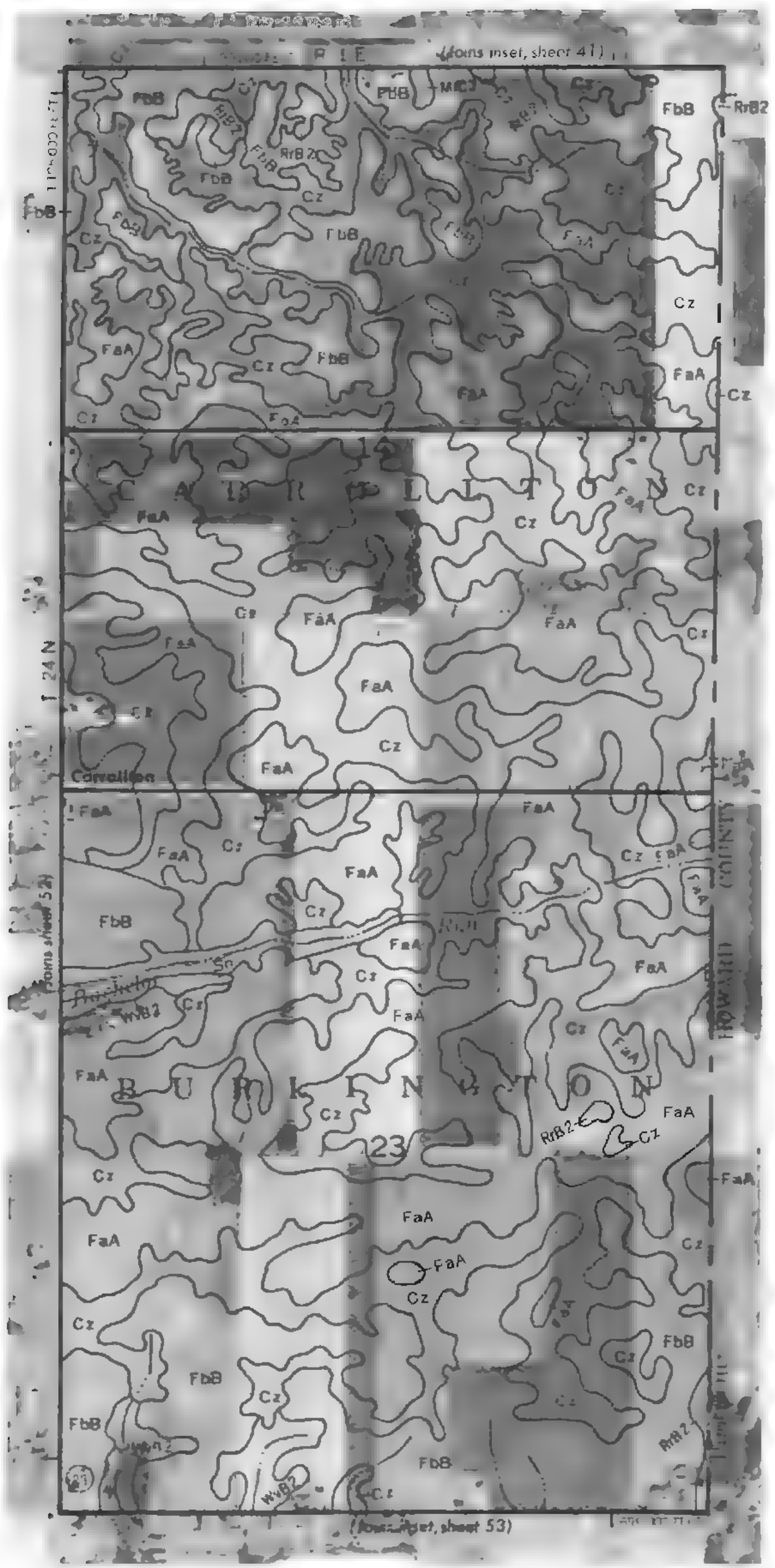
CARROLL COUNTY, INDIANA NO. 46

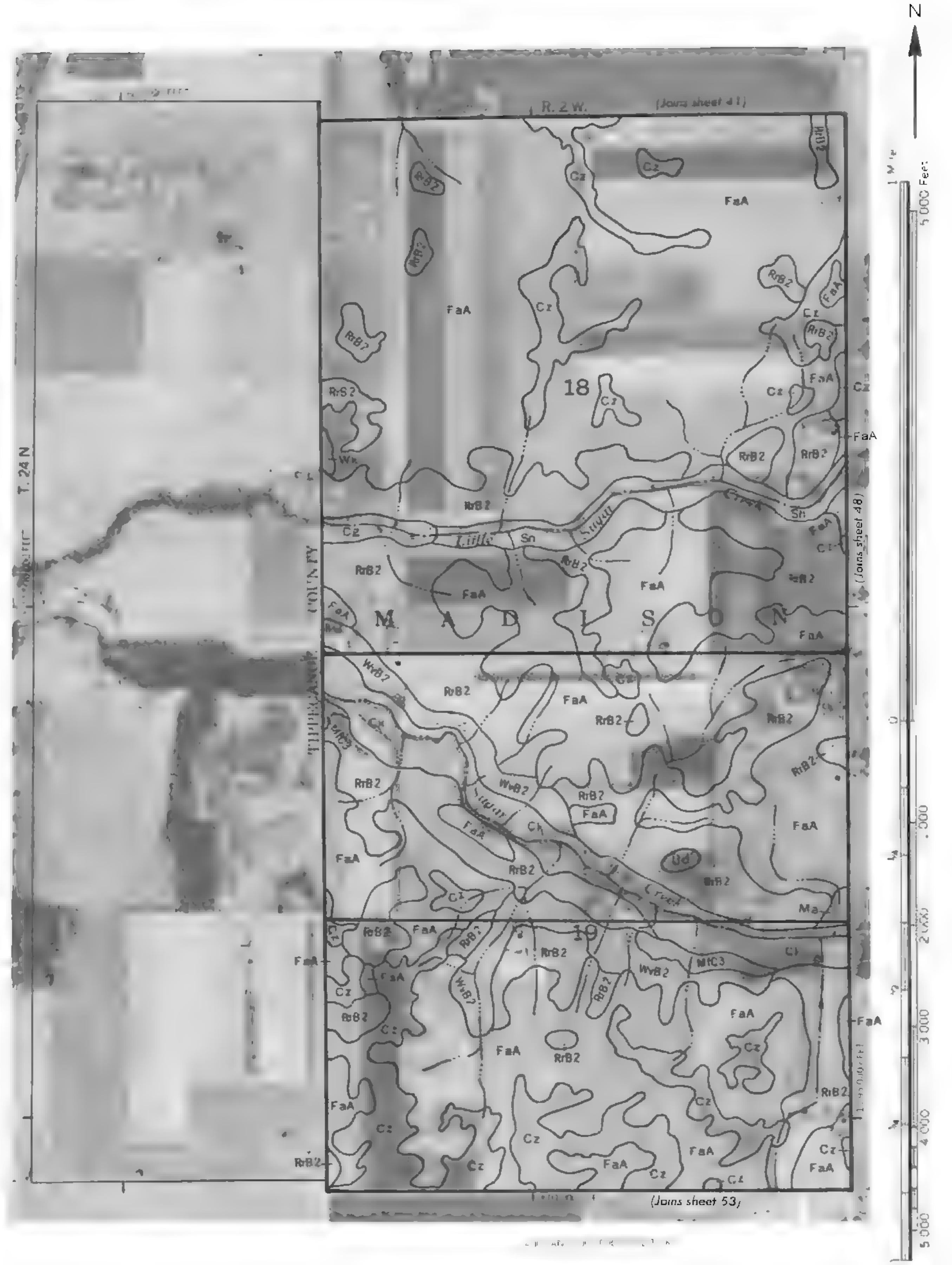
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1961 aerial photographs. Coordinate grid ... and ... approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

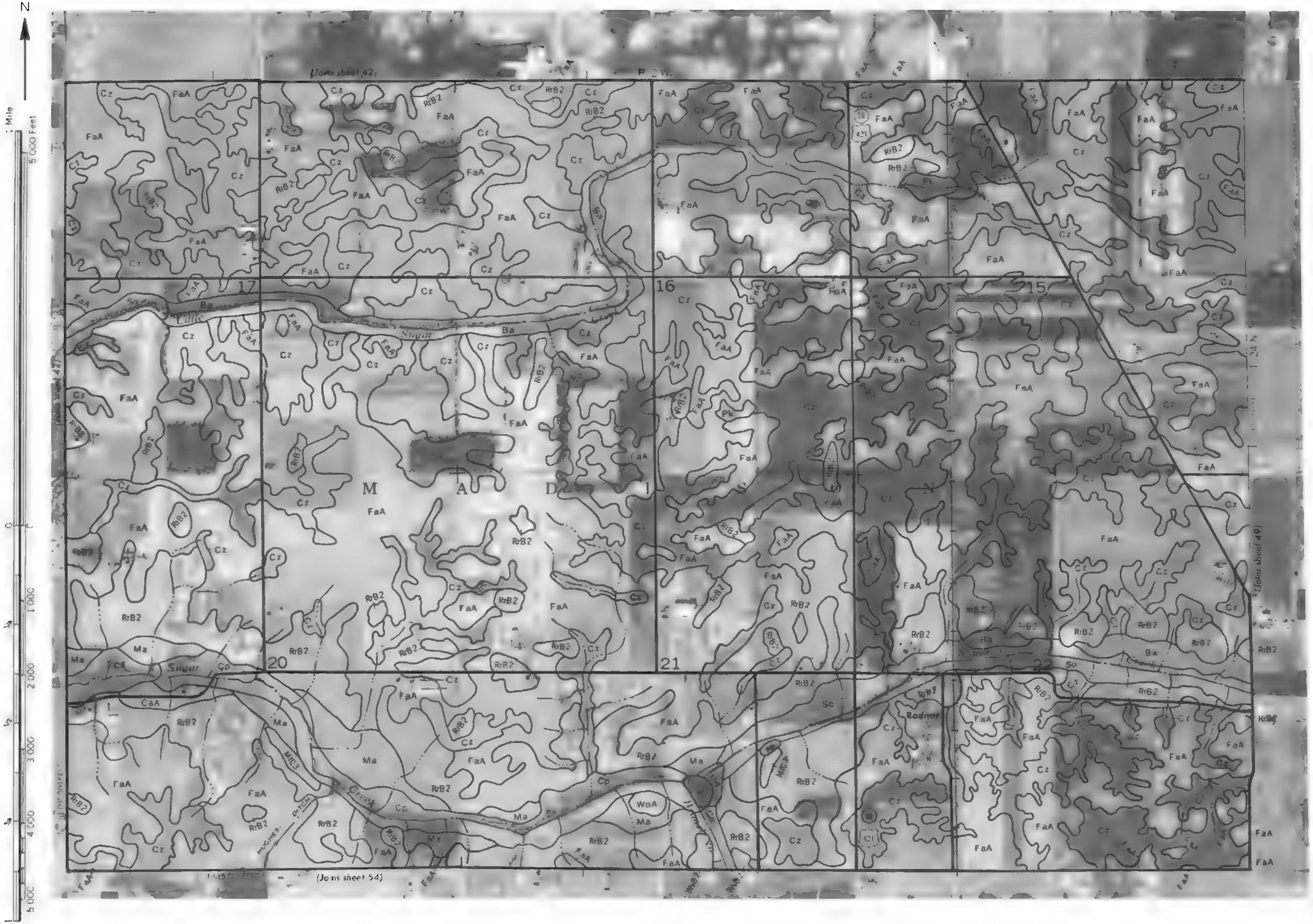
CARROLL COUNTY, INDIANA NO. 47

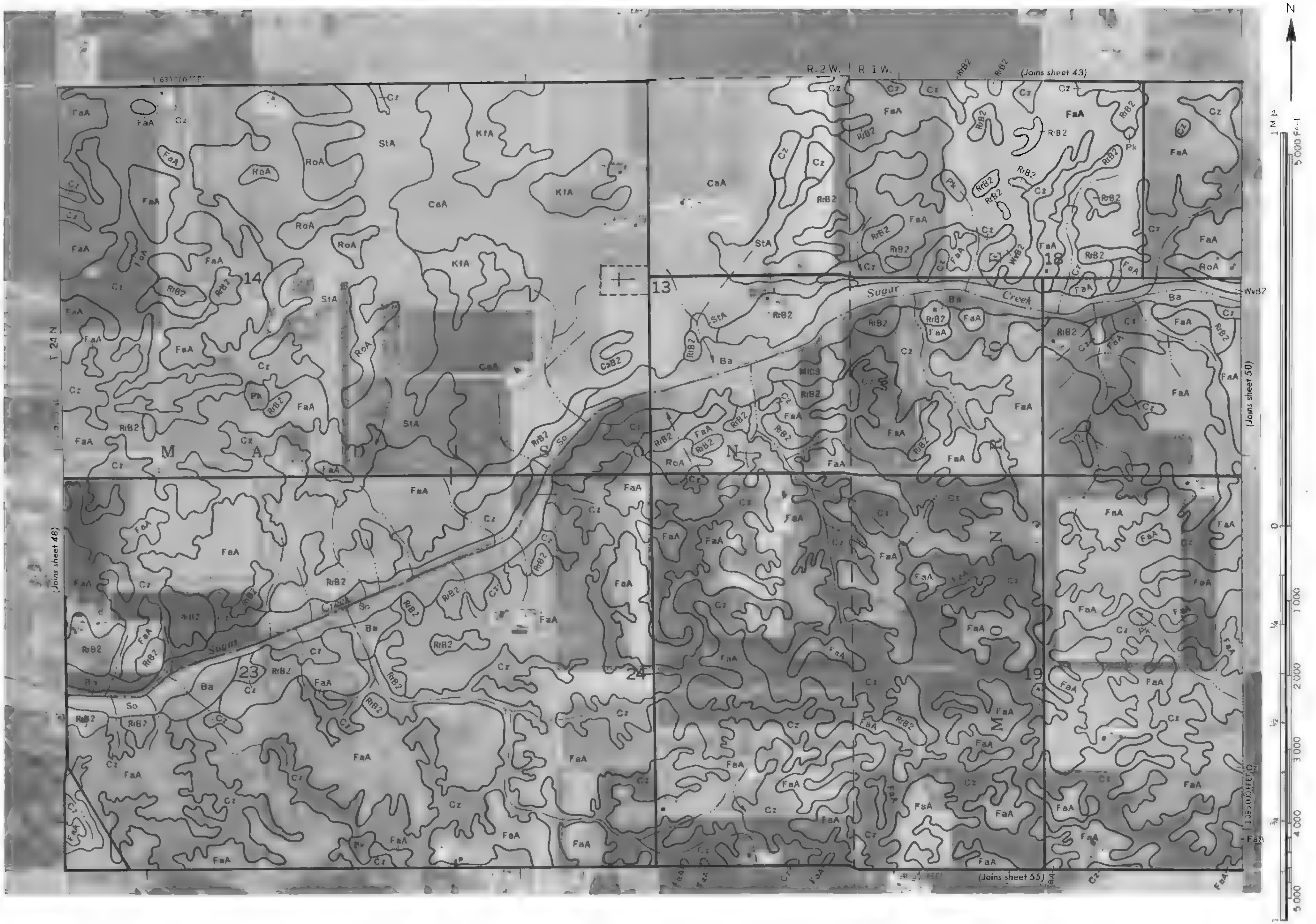
INSET





SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 48

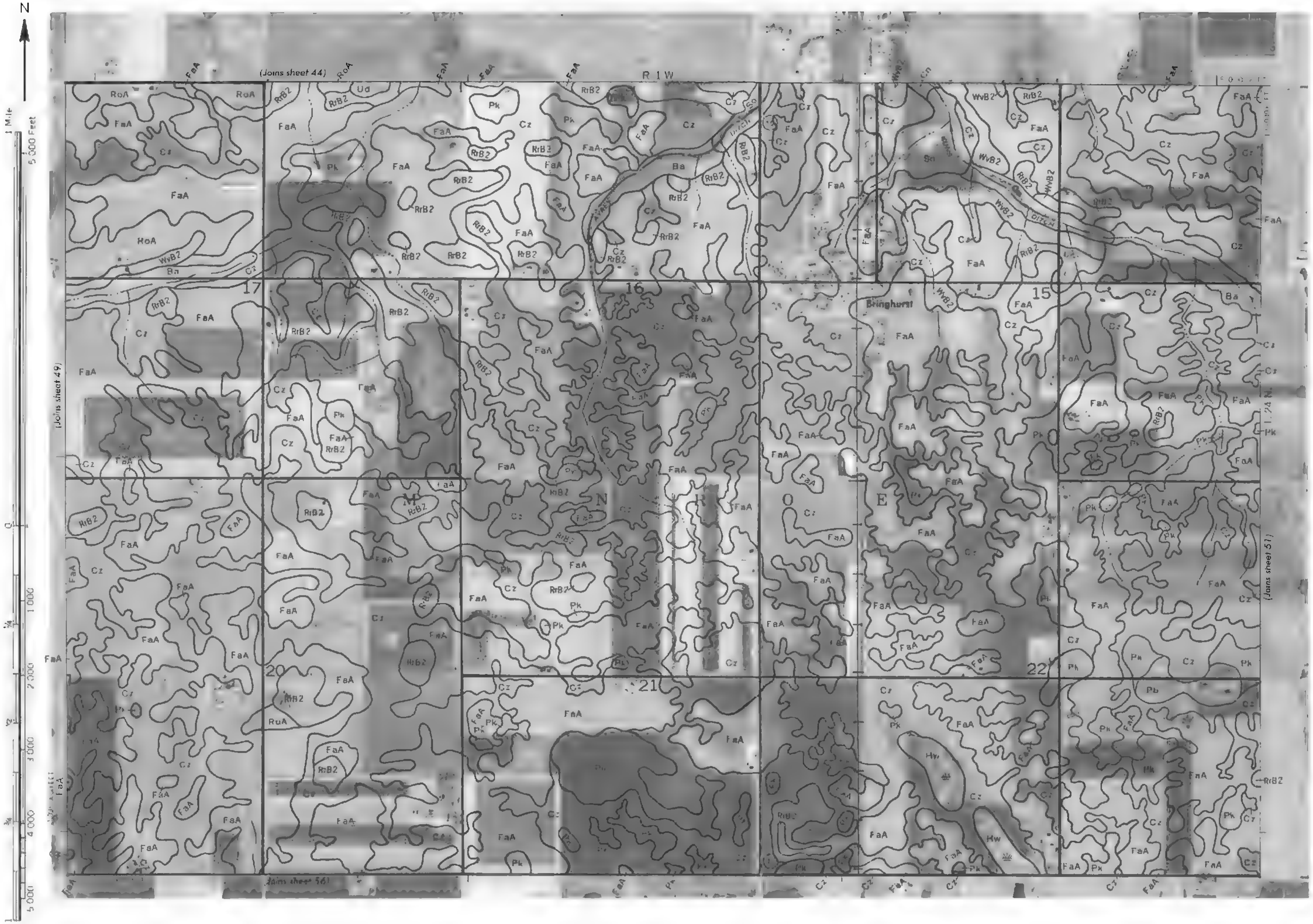




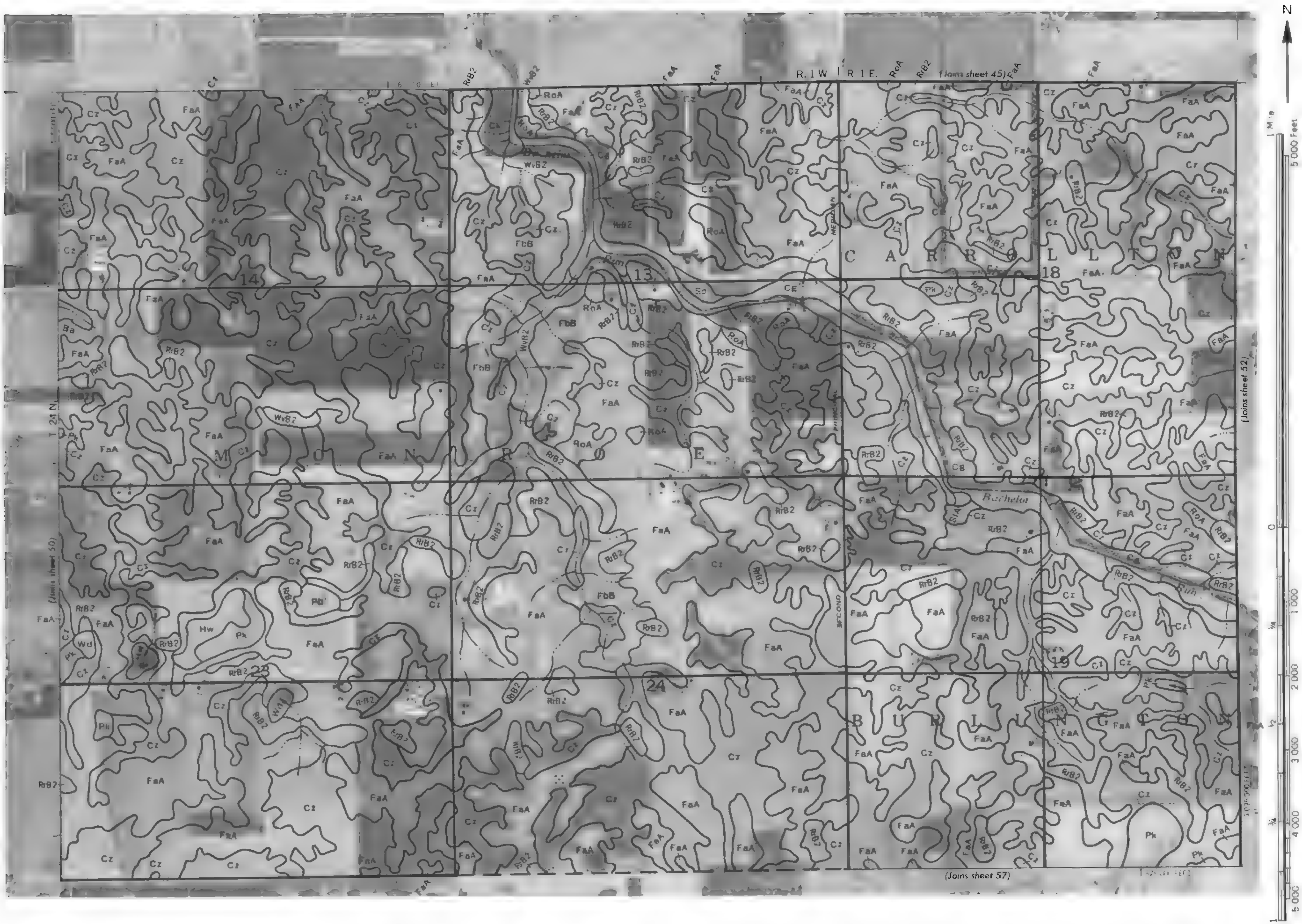
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 49

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 50



CARROLL COUNTY, INDIANA NO. 50

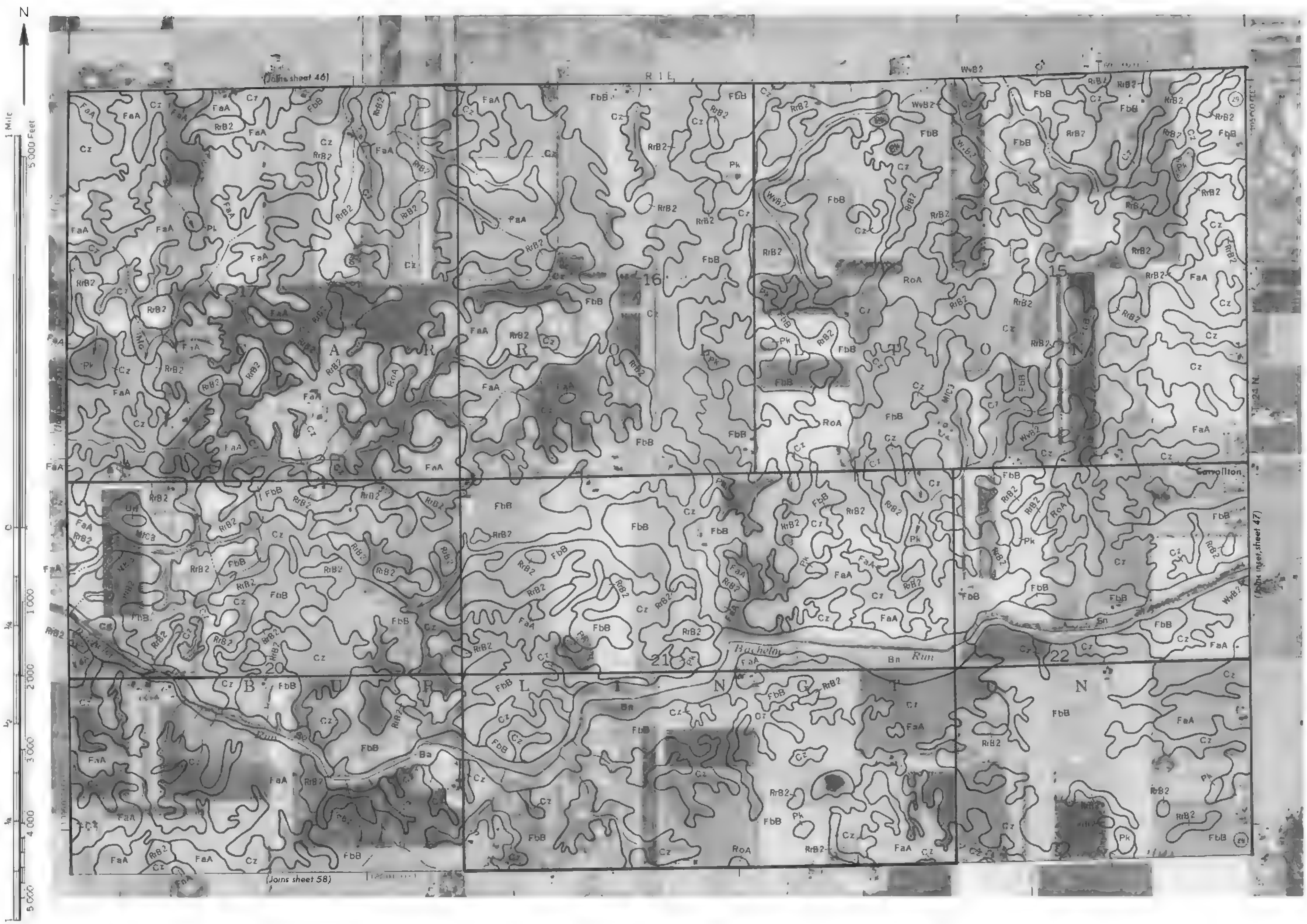


This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 51

52

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 52



CARROLL COUNTY, INDIANA NO. 52

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if

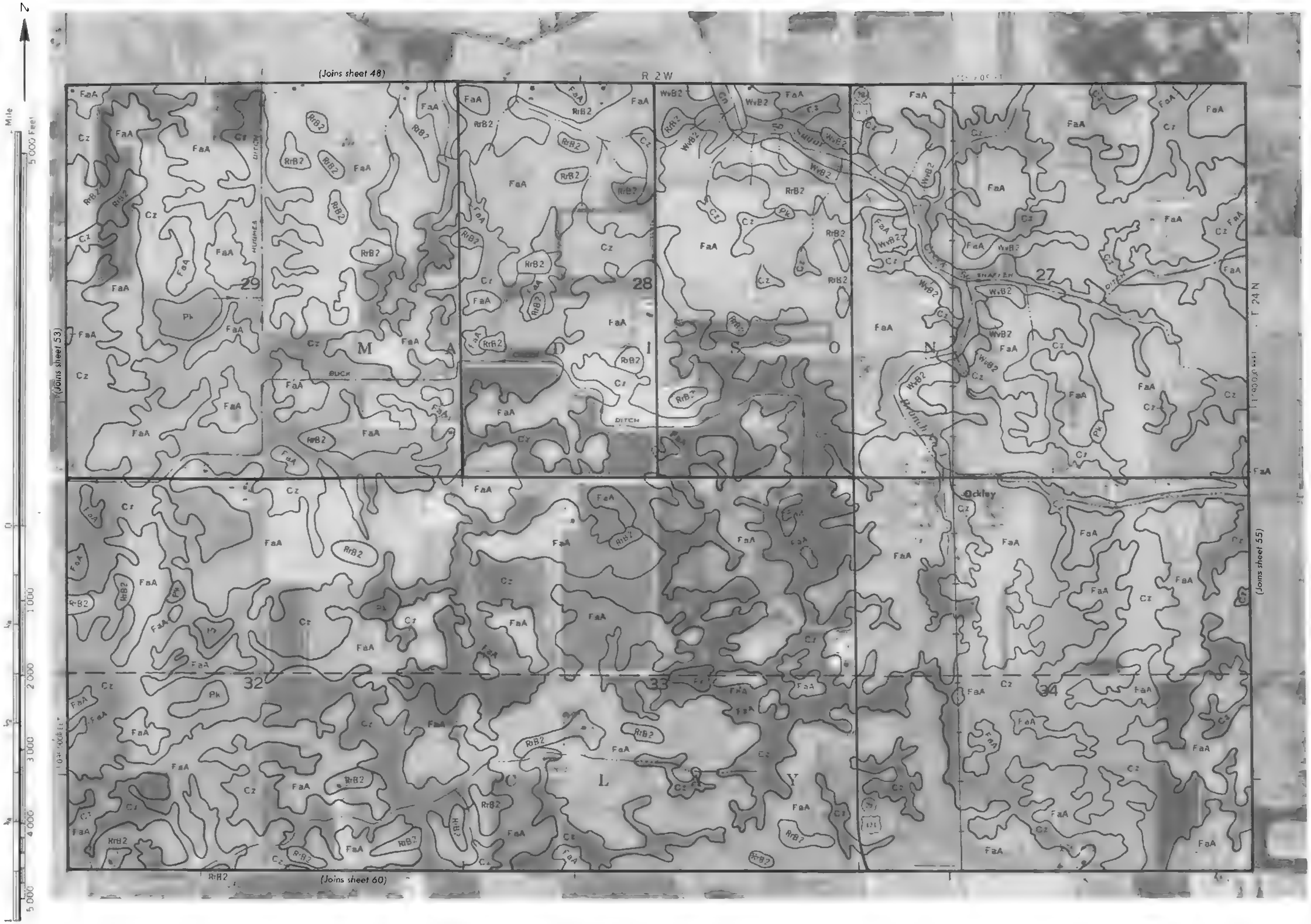
INSET

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

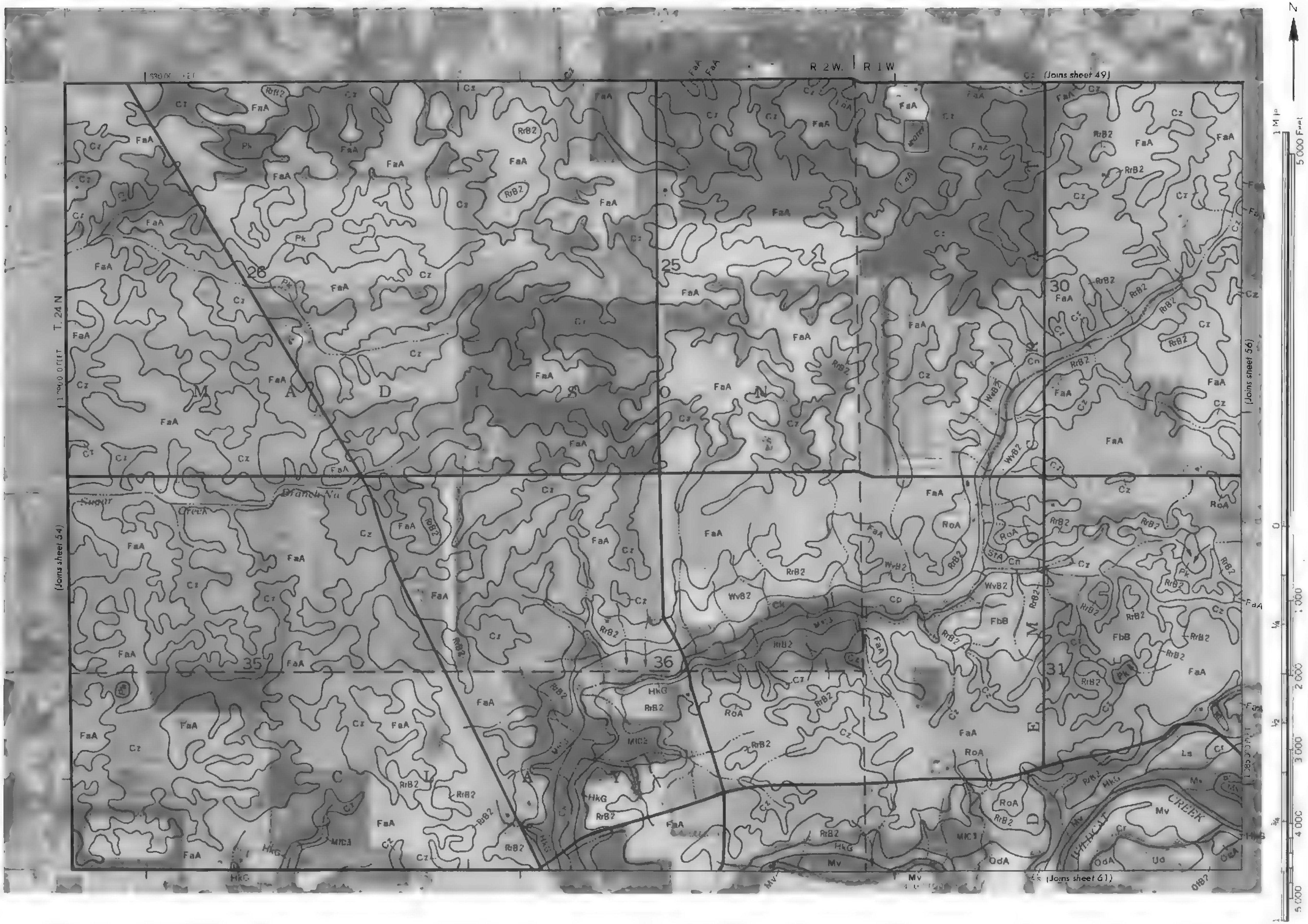
CARROLL COUNTY, INDIANA NO. 53

(54)

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 54



CARROLL COUNTY, INDIANA NO. 54

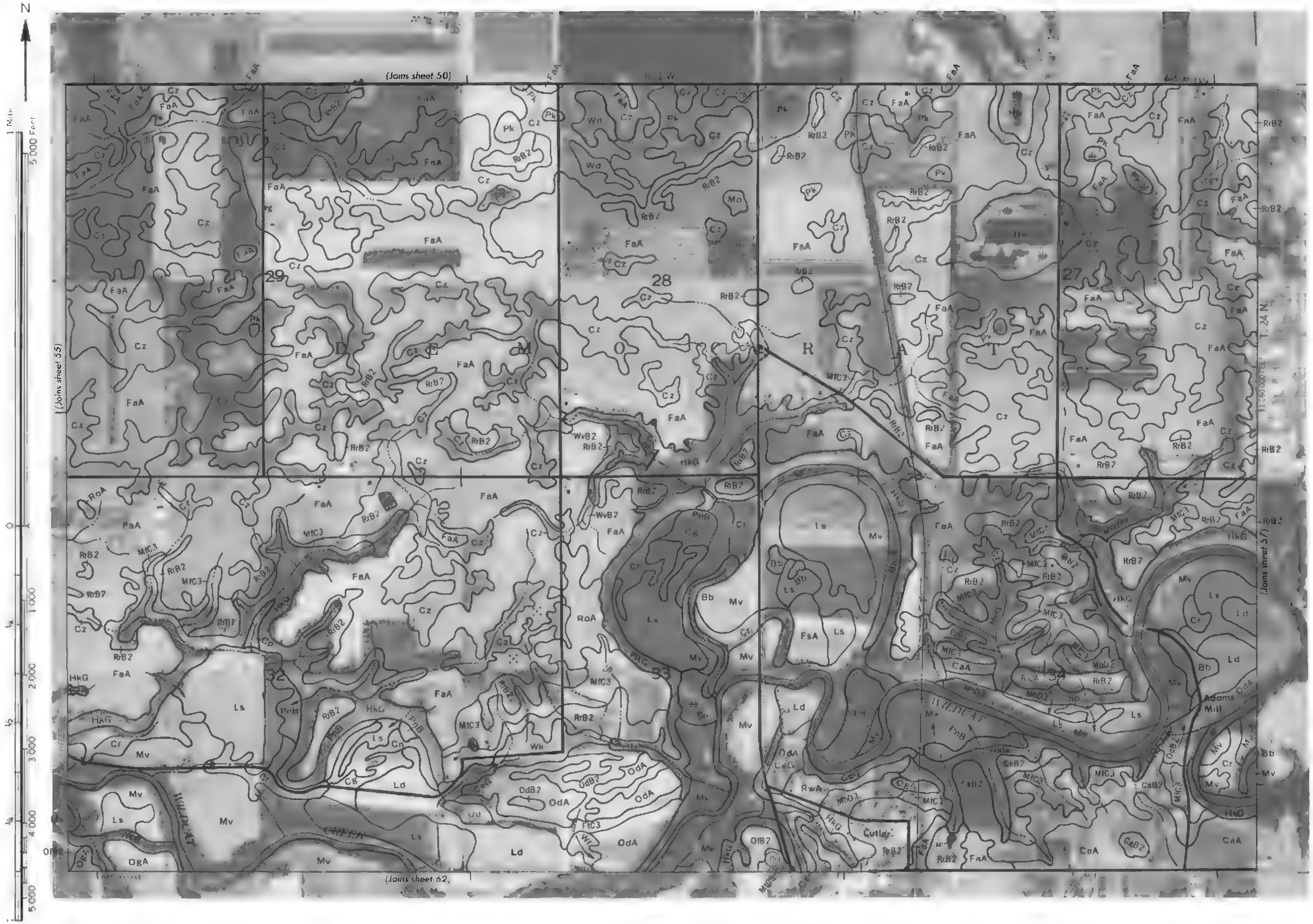


This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 55

56

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 56

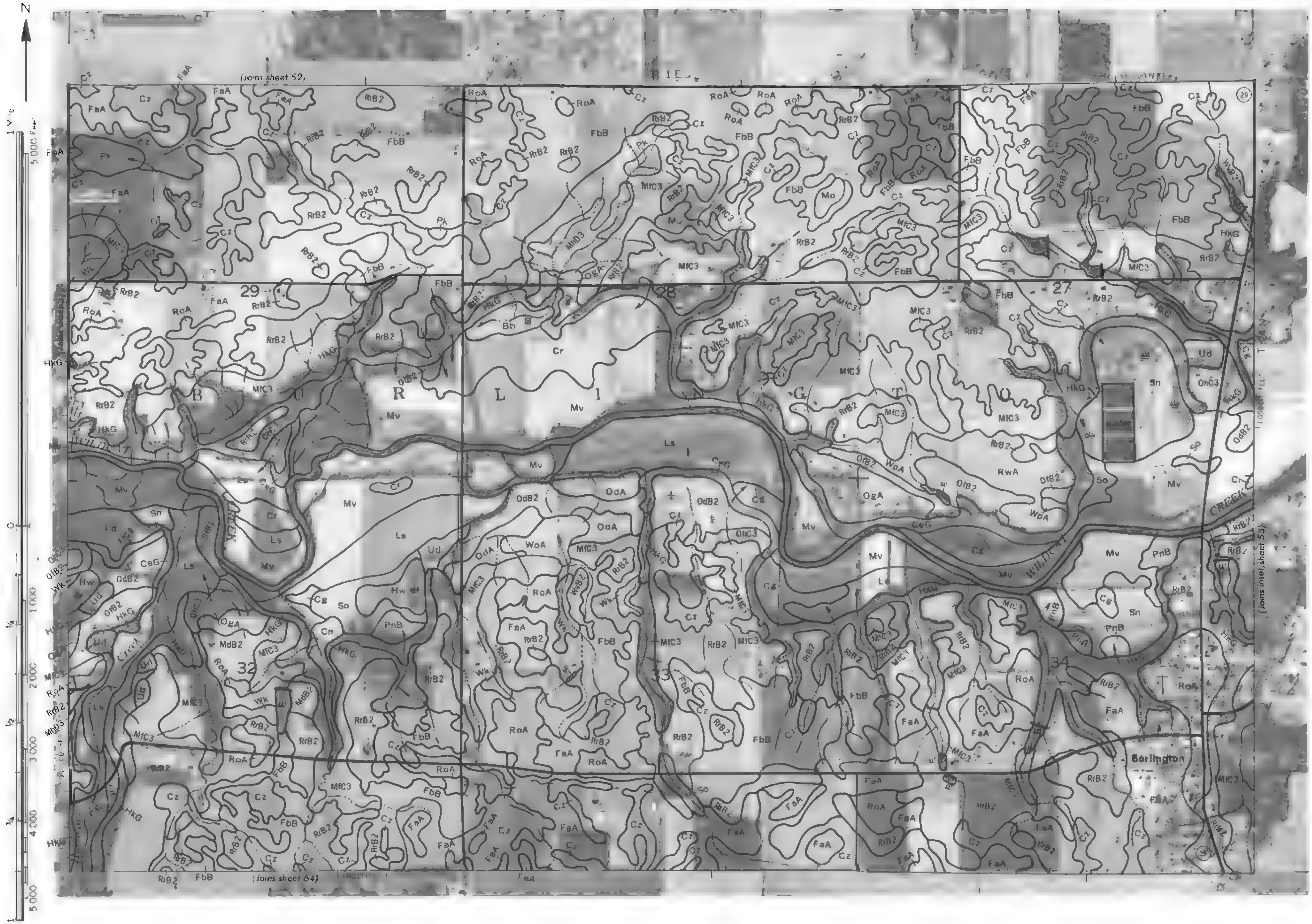


CARROLL COUNTY, INDIANA NO. 56

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 57

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 58



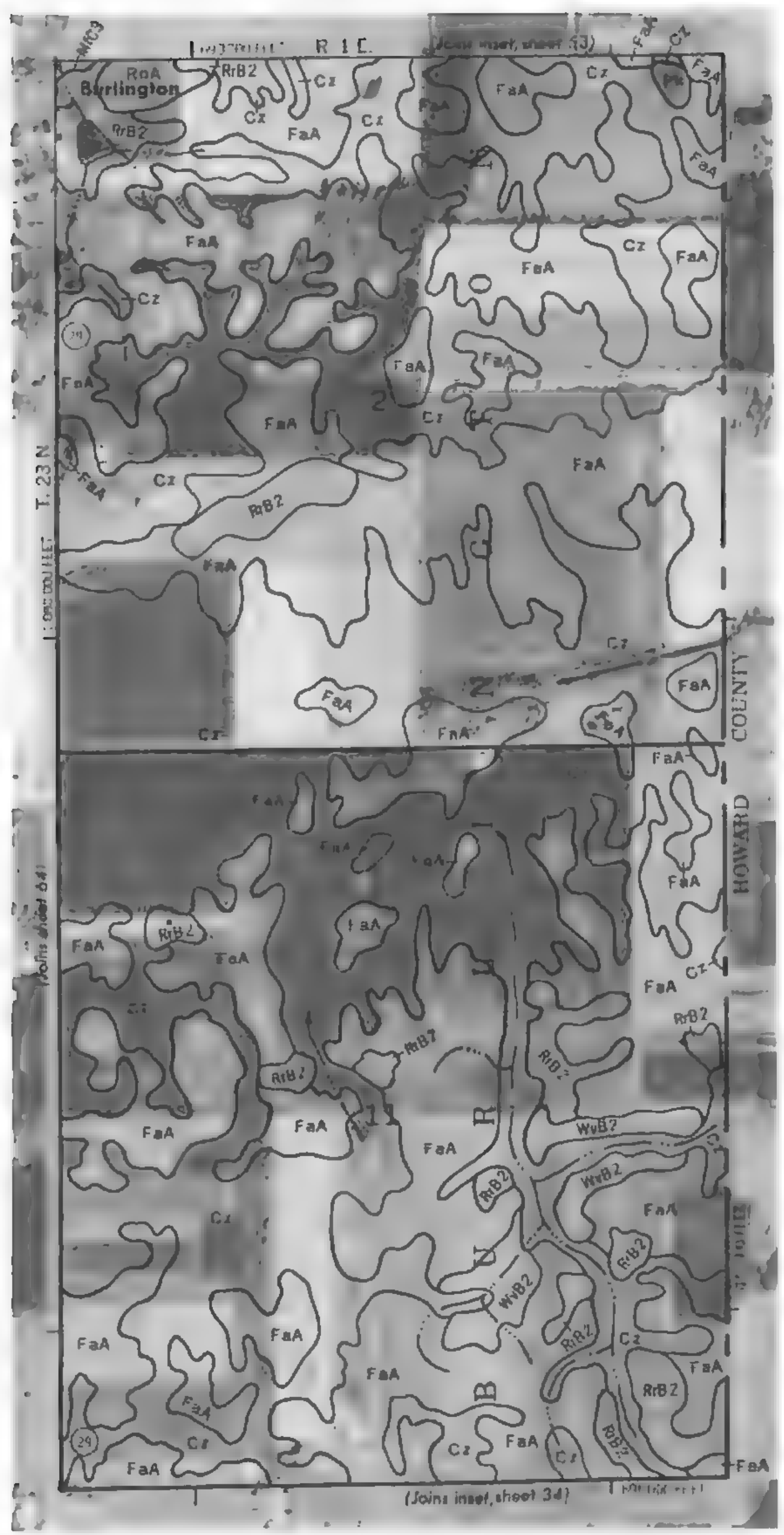
CARROLL COUNTY, INDIANA NO. 58

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photographs. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

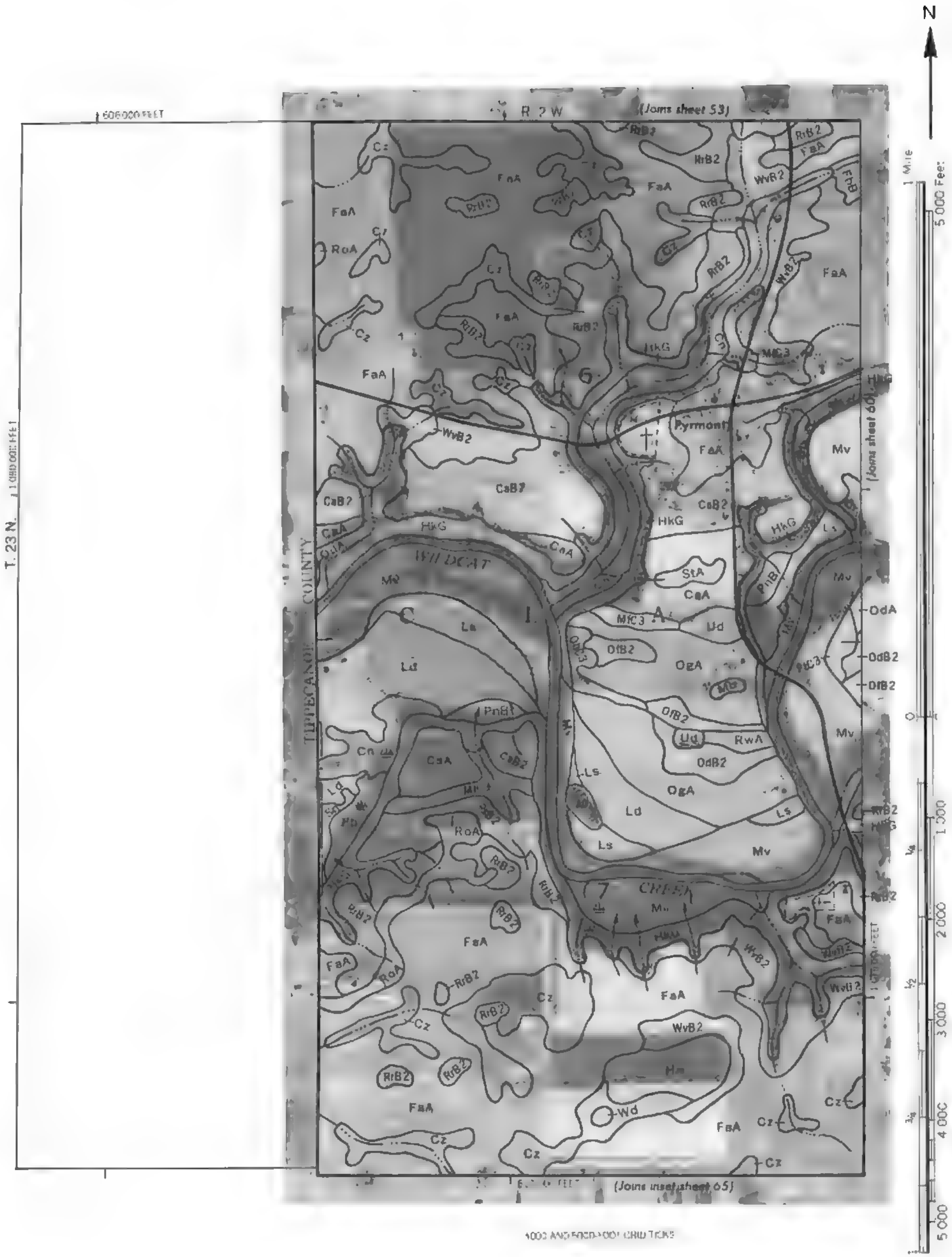
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 59

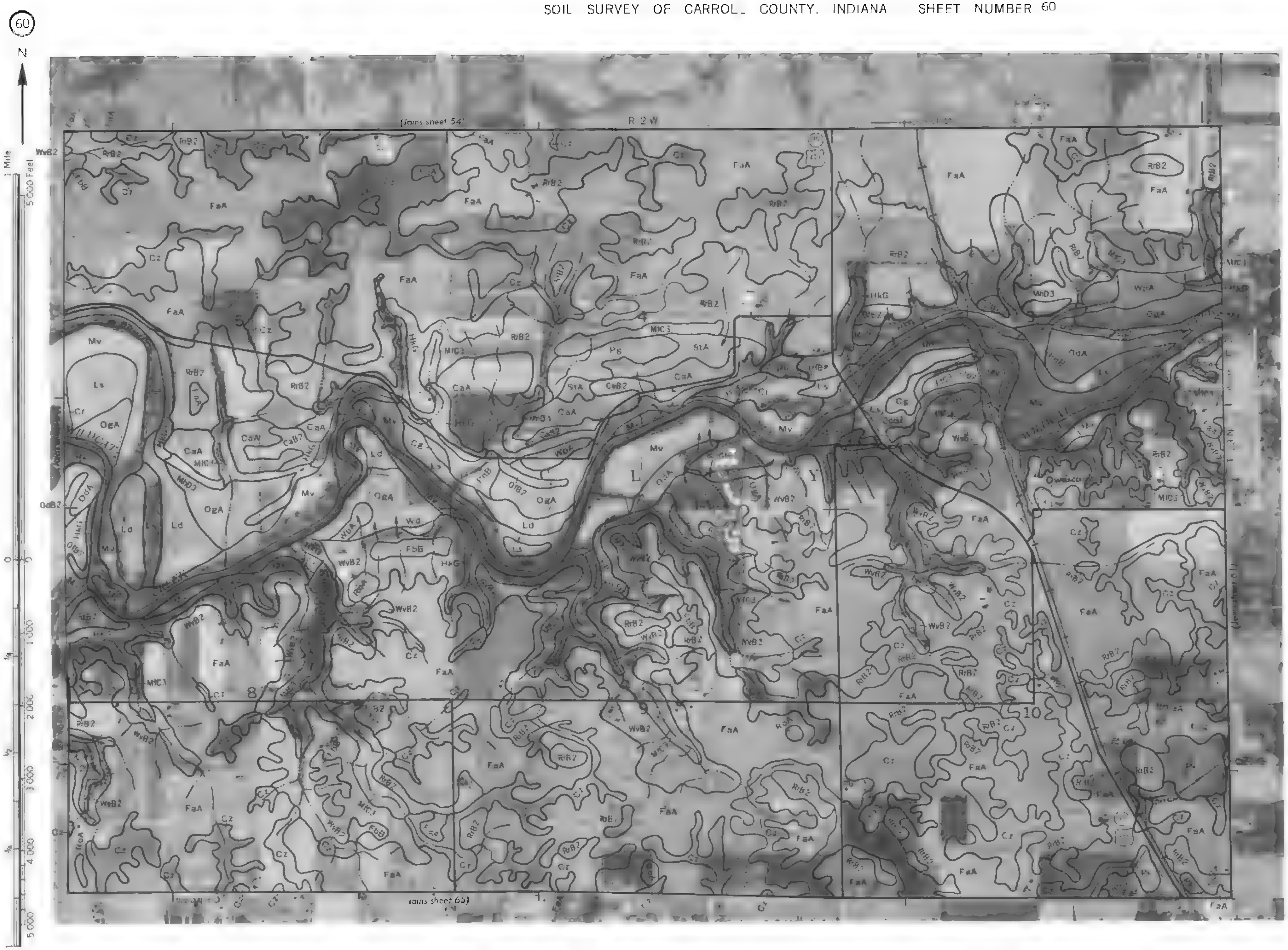
INSET



3000 AND 5000-FOOT GRID TICKS



3000 AND 5000-FOOT GRID TICKS

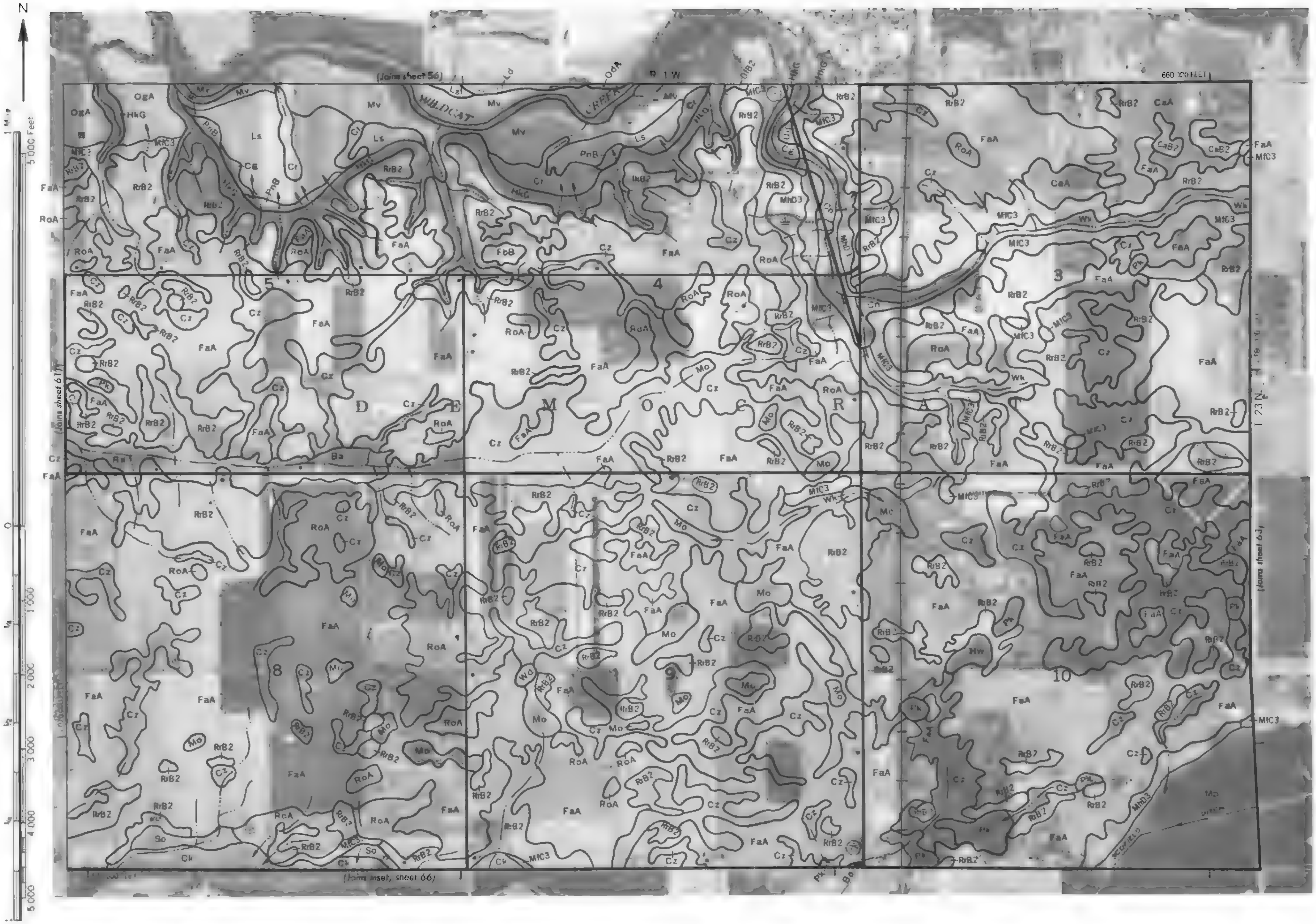


CARROLL COUNTY, INDIANA NO. 60

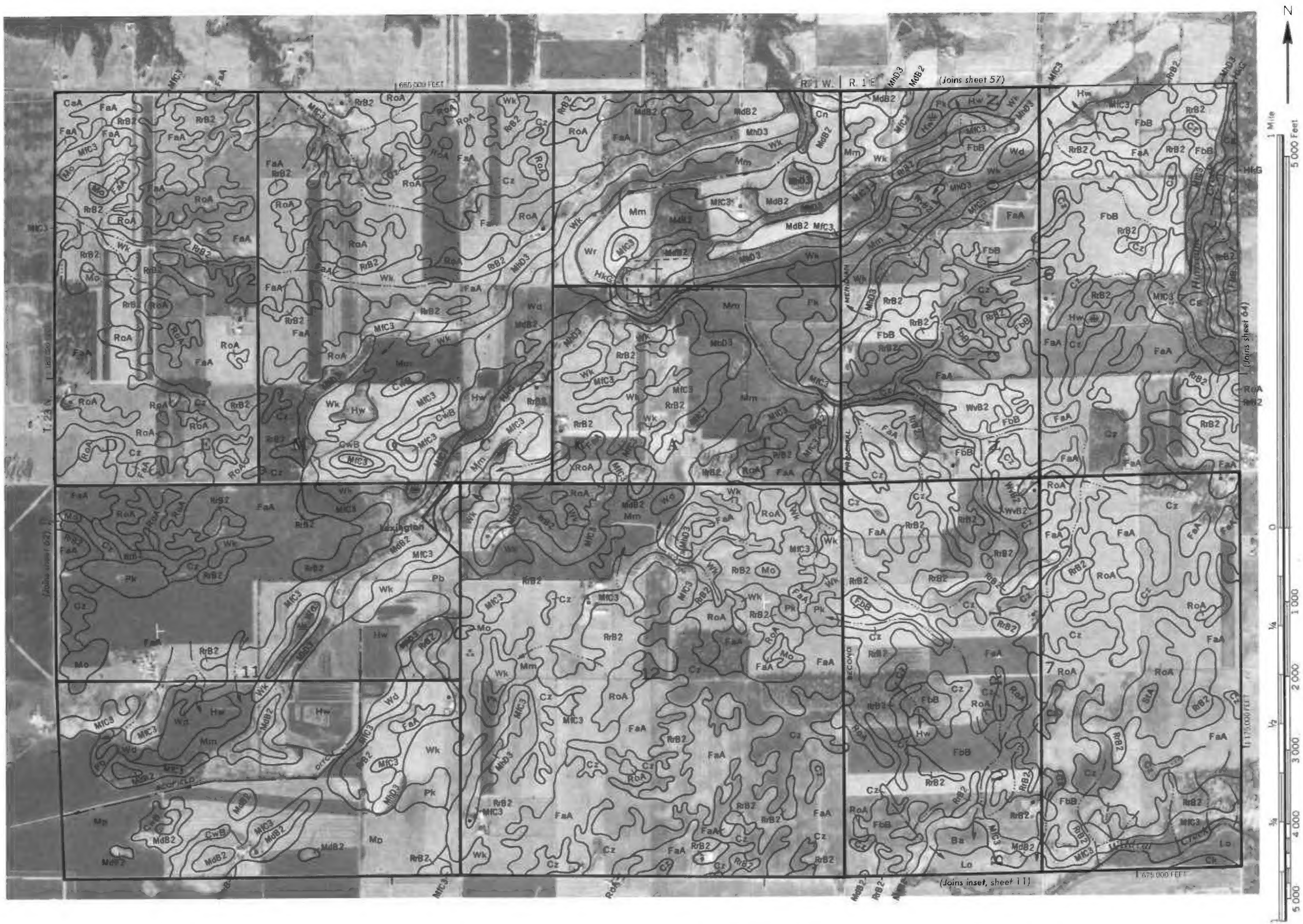
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CARROLL COUNTY, INDIANA NO. 61

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 62



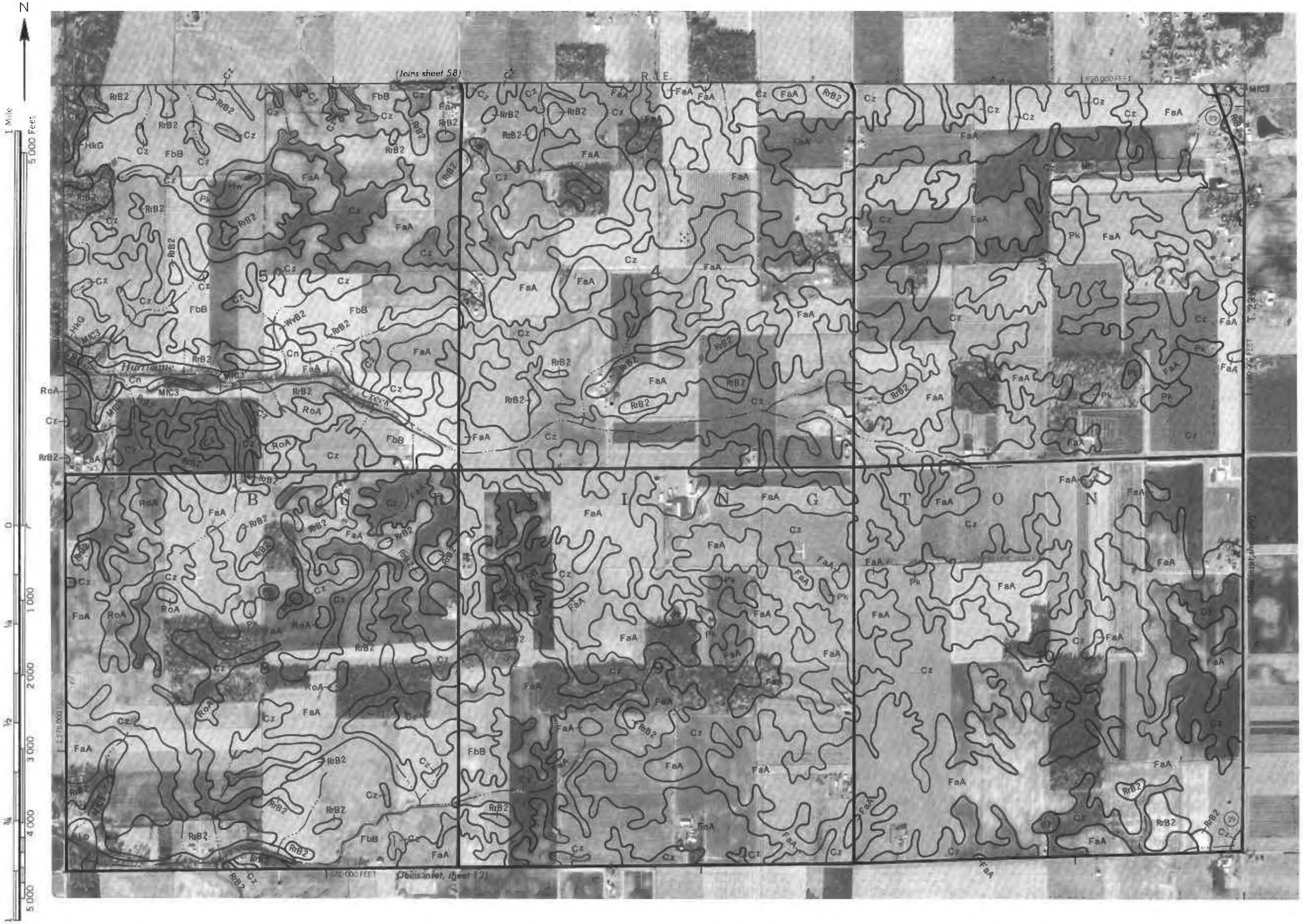
CARROLL COUNTY, INDIANA NO. 62
This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners



This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

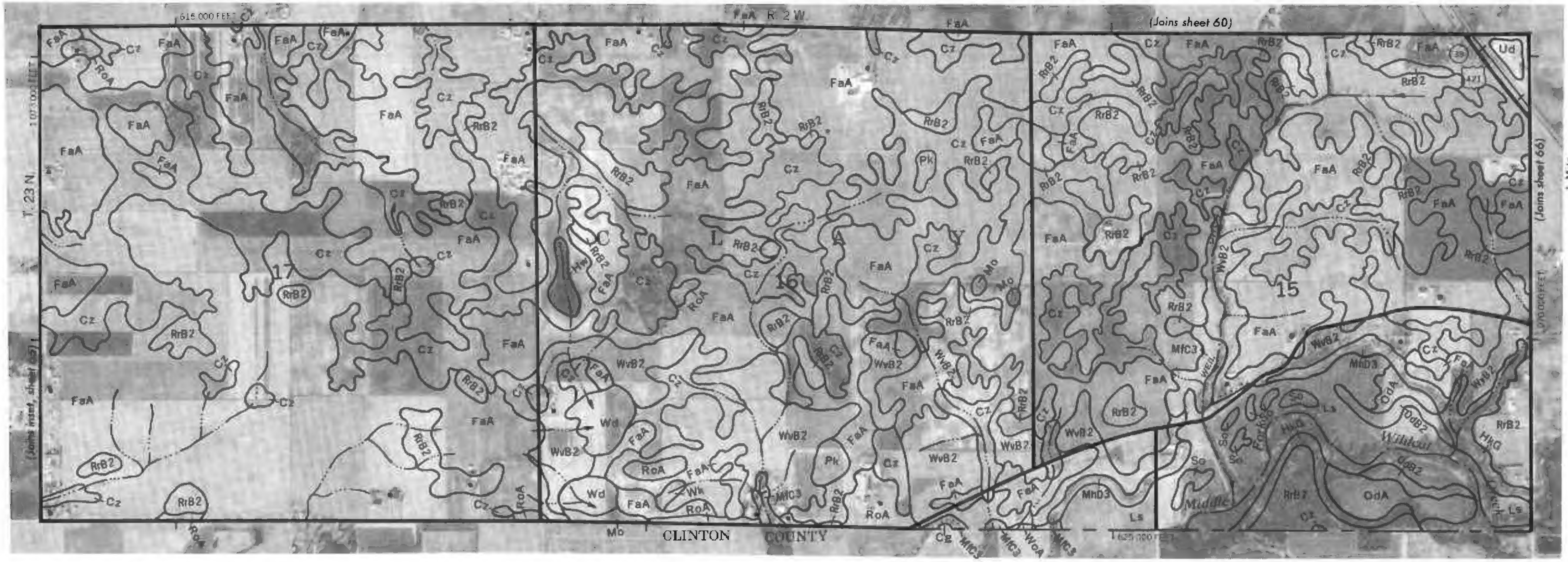
CARROLL COUNTY, INDIANA NO. 63

64

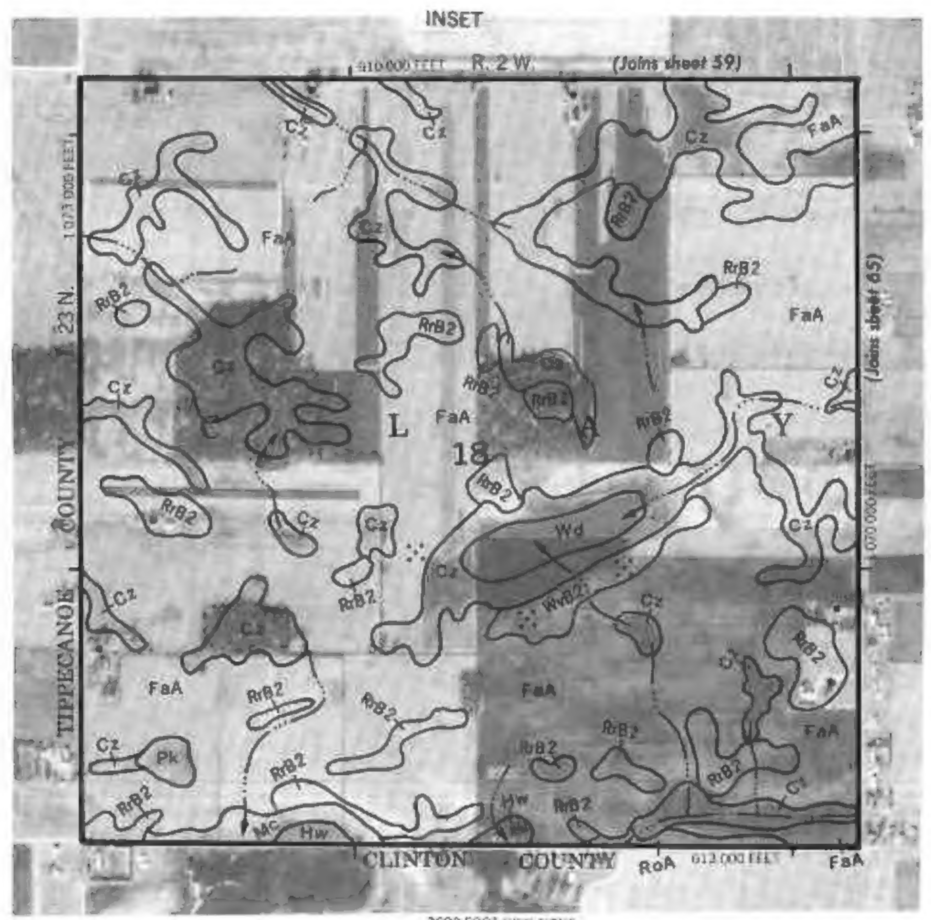


CARROLL COUNTY, INDIANA NO. 64

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



3000 AND 5000-FOOT GRID TICKS



3000 FOOT GRID TICKS

N

1 Mile | 5 000 Feet | 0 | 1 000 | 2 000 | 3 000 | 4 000 | 5 000

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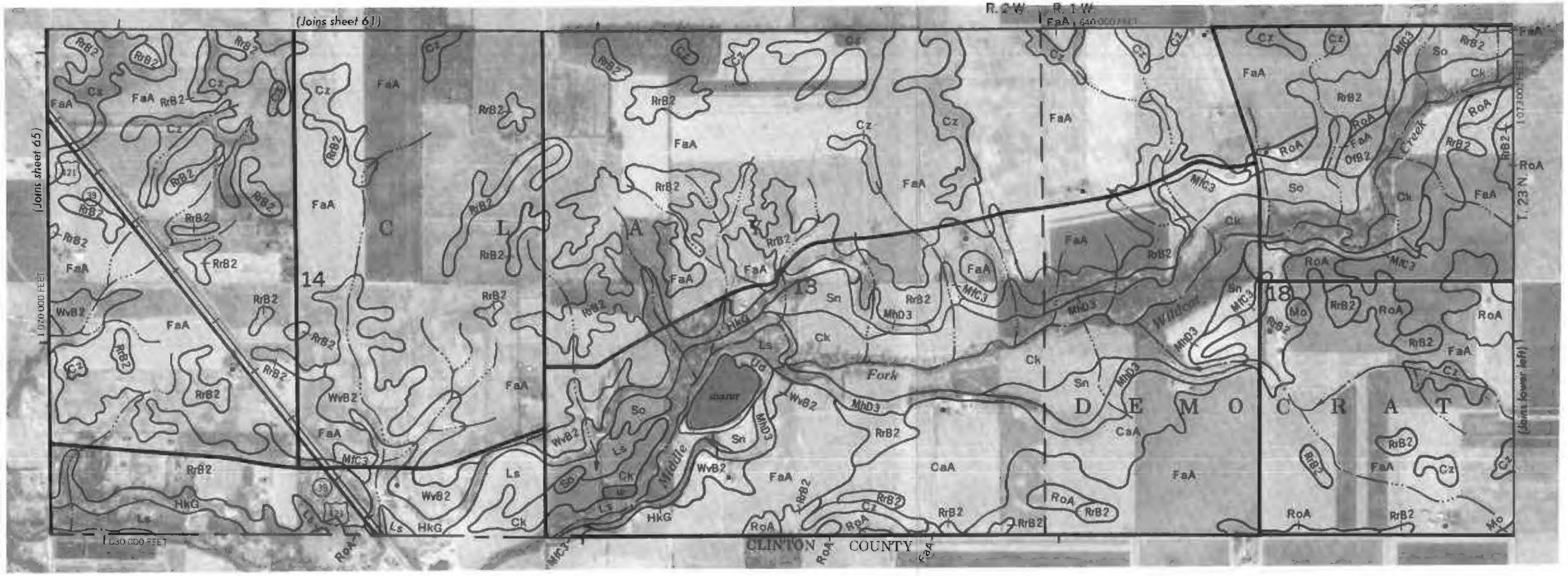
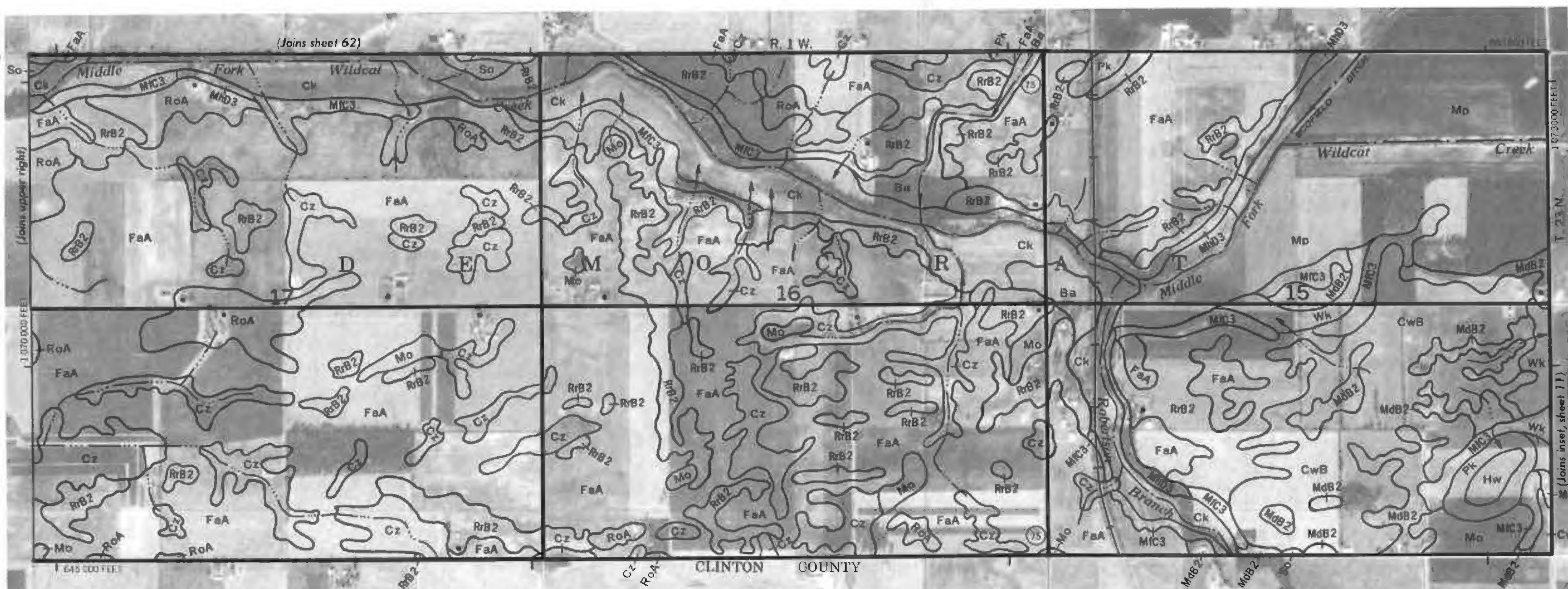
CARROLL COUNTY, INDIANA NO. 65

SOIL SURVEY OF CARROLL COUNTY, INDIANA — SHEET NUMBER 66



INSET



3000 AND 5000-FOOT GRID TICKS

CARROLL COUNTY, INDIANA NO. 66

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if